EXHIBIT 1

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

GLOBECON GROUP, LLC,

Plaintiff,

-against-

INTUITION PUBLISHING, INC. and PATRICK PANCOAST,

Defendants.

COMPLAINT AND JURY DEMAND

Case No.: 07 CIV. 2817
ECF CASE

JUDGE MARRERO

The plaintiff, GLOBECON GROUP, LLC, by its attorney, Eric J. Rotbard, Esq. as and for their Complaint against the defendants, allege as follows:

PRELIMINARY STATEMENT

1. This is an action for pecuniary and injunctive relief from copyright infringement arising under the Copyright Laws of the United States, Title 17 of the United States Code, together with pendent New York State claims for misappropriation of plaintiff's proprietary intellectual property and trade secrets, breach of contract, tortuous interference in contractual relations; theft and illegal disclosure of proprietary trade secrets, unfair competition and accounting.

2. The plaintiff alleges that the defendants misappropriated and infringed its valid copyright in many thousands of pages of proprietary materials developed exclusively by plaintiff over more than two decades.

3. The above-mentioned copyright includes, among other things, print, digital, interactive multimedia and audio-video content focused in capital markets topics such as cash market instruments, options, forwards, futures, swaps and derivatives; corporate finance topics such as cost of capital, corporate valuation, capital structure,

financial forecasting and modeling, mergers & acquisitions, leveraged buy-outs, restructurings, and asset securitization; credit and treasury subjects such as financial statement analysis, credit analysis and underwriting, cash management and treasury services; and, risk management topics such as hedging, wealth management topics such as asset liability management, portfolio management and risk management. These are among the many hundreds of specialized subjects covered by plaintiff's proprietary content.

4. These above-described proprietary materials comprising basic, intermediate and advanced content for professionals working in the banking, financial services and insurance sectors globally have been used by plaintiff for more than 25 years in the business of its conferences, seminars and workshops; its print publication and newsletters; its online distance education business; and, its various professional development consulting services.

5. Upon information and belief, the content was misappropriated and illegally used by defendants as-if-their-own to radically overhaul defendants' products and services to mimic those of plaintiff, to generate millions of dollars of ill-gotten revenues from stolen materials, to infringe upon the trademark identify of plaintiff and to undermine plaintiff's relationships with clients. The content constitutes the very core of plaintiff's business and valuable globally recognized brand serving banking, financial services and insurance companies. By use of stolen materials, defendants have caused incalculable losses of revenue and clients, and other actual and/or statutory damages. Plaintiff's copyright notices are clearly posted, and as needed filed with the United States Copyright Office.

JURISDICTION

6. The plaintiff is a limited liability company duly organized and existing pursuant to the laws of the State of Delaware, is authorized to do business as a foreign company in the State of New York and maintains a principal place of business at 1 West Street, Suite 100, At 17 Battery Place, City and State of New York 10004.

7. Plaintiff is in the business of serving the banking, financial services and insurance sectors by providing its conferences, seminars and workshops; its print publication and newsletters; its online distance education business; and, its various professional development consulting services.

8. Upon information and belief, the defendant INTUITION PUBLISHING, INC. (hereinafter "Intuition") is a domestic corporation, duly organized and existing pursuant to the laws of the State of New York, and has a principal place of business at 245 5th Avenue, Suite 2204, City and State of New York 10016.

9. Upon information and belief, Intuition is in the business of serving the banking, financial services and insurance sectors (among other businesses) by providing online distance education and its workshops, as well as various professional development consulting services. This portion of defendant Intuition's business directly competes with plaintiff.

10. Defendant PATRICK PANCOAST (hereinafter "Pancoast") is a natural person, and, upon information and belief, currently resides at 50 Traps Lane, New Malden, Surry KT3 4SA, United Kingdom. Pancoast is a natively born United States citizen who, upon information and belief, is regularly in the City, County and State of New York to solicit and conduct business on his own behalf, on behalf of his wholly

owned company "Market Abilities Unlimited, Inc." and on behalf of defendant Intuition as either an employee or full-time consultant.

11. This Court has jurisdiction over the subject matter of this action as provided for in 28 U.S.C. §§ 1331 and 1338(a) and (b).

12. This Court has jurisdiction over defendants in that defendant Intuition was incorporated in the State of New York and maintains its principal place of business in this District, and that, upon information and belief, defendant Pancoast is an agent, servant or employee of defendant Intuition, and because defendants committed acts of misappropriation of plaintiff's proprietary intellectual property and trade secrets, breach of contract, tortuous interference in contractual relations; theft and illegal disclosure of proprietary trade secrets, unfair competition and accounting of damages during the course of their business in this District.

13. Venue is proper in this District pursuant to 28 U.S.C. §§ 1391(b)(2) and (3) and 1400, as plaintiff's claims arose in this District, and/or the defendants may be found in this District.

FACTS

14. At all times relevant hereto, plaintiff was and still is engaged in the banking, financial services and insurance sector business of providing, among other things, conferences, seminars and workshops; including print publication and newsletters, online distance education and various professional development consulting services.

15. In January 2002, Plaintiff acquired the assets of a company now known as XGGL, Inc. ("XGGL," or "Old Globecon"), including the XGGL proprietary content and contractual rights with regard to Old Globecon's former employees and consultants.

16. At all times relevant hereto, defendants Intuition and Pancoast have been and still are engaged in a nearly identical business to plaintiff; and as such, have been and still are direct competitors of plaintiff.

17. Pancoast was an employee to plaintiff and Old Globecon for approximately 7 years beginning from on or about January 20, 1987, until sometime during 1994.

18. During this time, Pancoast reported on his resume submitted to plaintiff that he "managed a seminar business employing eight teaching consultants representing $5 million of revenues each year."

19. Upon leaving Old Globecon in 1995 and through the year 2000, Pancoast formed and operated Market Abilities Unlimited, Inc., where he purportedly to "taught over 100 days of seminars each year and managed [a] four-person company."

20. During a near identical period of time, 1995 through 1999, Pancoast allegedly was "Director of Product Education" at Barclays Capital Group. No where on Pancoast's resume is listed or identified any intellectual property he created or published while at his own company or Barclays Capital Group, nor did he at that time report to plaintiff the creation and ownership of such property.

21. Upon information and belief, sometime following February 2000, Pancoast acted as a consultant, advisor or employee of Cygnifi Derivative Services LLC in the role of "Sales Director, Europe" until October 2001.

22. From February 15, 2002, until on or about April 10, 2003, Pancoast was a full-time employee of plaintiff.

23. Thereafter, upon information and belief, Intuition immediately hired Pancoast as either a full-time employee or consultant in the role of "Chief Learning Officer," where he remains employed to date.

24. The professional training and education industry is a highly competitive field, and plaintiff's success in that industry is substantially dependent upon the quality of course and training materials, the strength of its client relationships, proprietary sales databases, industry reputation, access to capable instructors and ability to obtain repeat business from new and existing clients. Defendants' alleged actions described herein, directly and significantly damaged plaintiff's business, causing the diversion of many millions of dollars of business and the potential for continuing irreparable damage if their actions do not cease.

25. In connection with plaintiff's business activities, plaintiff employs key staff members each of whom is assigned a particular sphere of work, including management of content development, instructional delivery, client engagements, instructor services and client sales, among other things. Each key employee is engaged by plaintiff pursuant to a written employment agreement and a confidentiality, intellectual property, non-circumvent and non-compete agreement. Upon signing such agreements, each key employee agrees explicitly and implicitly to conduct themselves according to the highest business standards, to acts as trusted members of plaintiff's team to ensure the highest standards of ethieal conduct, to protect plaintiff's proprietary

content from conversion or theft, and to deliver the highest quality of program delivery and service to plaintiff's clients.

26. Defendant Pancoast was a key employee of plaintiff's, he read, agreed to and signed plaintiff's standard Confidentiality, Intellectual Property and Non-Circumvention Agreement (the "CIPNCA") to permit him access to sensitive and confidential plaintiff proprietary materials, client lists and contacts, sales databases, instructors, and other confidential information. The CIPNCA is referenced specifically in Pancoast's employment agreement with the plaintiff, which Pancoast separately signed (described later herein). Among the key components of the CIPNCA Pancoast signed are confidentiality, non-disclosure clauses, as well as restrictive covenants not to compete with the plaintiff for a short and reasonable period of time following such employment. Confidential information is clearly defined in the CIPNCA:

> Confidential information or material of Globecon or its subsidiaries is any information or material: (a) generated or collected by or utilized in the operations of Globecon or its subsidiaries, (b) received from any third party, or (c) suggested by or resulting from any task assigned to me or work performed by me for or on behalf of Globecon or its subsidiaries, and which has not been made available generally to the public, whether or not expressed in a document or other medium and whether or not marked "Globecon Confidential" or with any similar legend of Globecon or any third party. Confidential information includes any non-public information disclosed to me either directly or indirectly, in writing, through electronic media, orally, or visually, in connection with any discussions and/or transactions regarding Globecon. Confidential information includes any and all software, source code, systems documentation, application design and specification documentation and related materials directly or indirectly associated with Globecon's e-learning application known as Fintranet, and any supporting operational databases, interfaces and components.

27. Plaintiff's ability to obtain new and repeat business from clients is dependent upon the protection of this proprietary and confidential information. Such

information has been treated at all times as confidential by plaintiff and Old Globecon and constitutes its trade secrets.

28. The information, procedures and methods constituting plaintiff's development and use of its confidential information are not ascertainable by those outside plaintiff's organization, have always been treated as proprietary and confidential by plaintiff, and constitute proprietary information and trade secrets.

29. Employees who breach the CIPNCA while employed by plaintiff or thereafter and provide competitors or new employers with this information have a very distinct competitive advantage because the information, upon information and belief, is widely recognized for its superior quality, depth and breadth, as well as the enormous volume of materials. The proprietary content of plaintiff represents many millions of dollars of investment by a collective effort by plaintiff's staff over many years. In creation of this confidential and proprietary content, plaintiff developed and maintains a variety of proprietary standards, guidelines, processes and standards that, along with the content, are not generally known and/or readily available to others who might benefit from access to the information.

30. The aforementioned trade secrets and confidential information represents vital keys to the future business success of plaintiff.

31. Among other aspects of the confidential information, key employees of plaintiff have direct access to senior executives of plaintiff's clients, as well as to its instructors, presenters and facilitators.

32. Because of the sensitive nature of these relationships between plaintiff, its customers and its instructors, key managers or professional and technical employees

who sign the CIPNCA are bound by a clear an unambiguous restrictive covenant ("Restrictive Covenant") which in part states:

> Throughout the term of my employment with Globecon and for a year thereafter and regardless of the reason of my departure and/or termination, that without Globecon's prior written I shall not, directly or indirectly:
>
> a. Solicit or be or become associated with or the direct or indirect economic or financial beneficiary of any entity "in any capacity [Footnote 1]" which solicits, specifically and narrowly, any Globecon's "customers" and/or "sales prospects [Footnote 2]" AND is a "direct competitor to Globecon [Footnote 3]."
>
> b. Aid or agree to aid any partner, shareholder, owner, officer, advisor, consultant, director, employee, principal, agent, creditor, trustee, co-venturer or other party related to of Globecon to leave its employ or aid or agree to aid any competitor, customer or supplier in any attempt to hire any person who was associated with Globecon during my employment and during the twenty four (24) months immediately preceding this agreement.
>
> [Footnote 1 above states: "The term 'in any capacity' includes, without limitation, as a partner, shareholder, owner, officer, advisor, consultant, director, employee, principal, agent, creditor, trustee, co-venturer or otherwise."]
>
> [Footnote 2 above states: "The term 'customers' applies specifically to clients of Globecon during my employment, or those customers have been clients of Globecon during the twenty four (24) months immediately preceding this agreement; and, the term 'sales prospects' applies specifically to individuals and/or entities which have received proposals from Globecon and/or are on one or more sales prospect lists of Globecon during my employment or during the twenty four (24) months immediately preceding this agreement."]
>
> [Footnote 3 above states: "A "direct competitor to Globecon" is any person, partnership, corporation, company or other entity which provides education, professional development; workshop; seminar; online distance learning; interactive educational services; and/or financial service and finance-

> related instructional design and/or consulting or advisory services or products."]

33. The CIPNCA and its Restrictive Covenant guard against the release of inside, unique and proprietary information and unfair competition as such employees are in a position to damage plaintiff in tangible or significant ways once their employment with plaintiff terminates.

The Agreements

34. Defendant Pancoast was employed by Old Globecon as an executive with increasing levels of responsibility from on or about January 20, 1987, until sometime during 1994.

35. From 1995 through 2001, upon information and belief, Pancoast did business as "Market Abilities Unlimited, Inc." and also acted as a consultant, advisor or employee of Cygnifi Derivative Services LLC at sometime following February 2000 up until October 2001, shortly before his employment by plaintiff.

36. Defendant Pancoast was employed by plaintiff Globecon as a Managing Director, from on or about February 15, 2002, until on or about April 10, 2003. A copy of his jointly signed employment agreement dated as of February 15, 2002 is annexed hereto as Exhibit "A" (the "Employment Agreement"). A copy his jointly signed CIPNCA dated as of February 15, 2002 is annexed hereto as Exhibit "B" (the "CIPNCA").

37. Along with many dozens of his colleagues who were subject matter experts, Pancoast was involved in developing content for plaintiff's self-instructional guides, workshops, cases and spreadsheets, among other types of content, and delivering

workshops. Authorship of plaintiff's content always has resided with plaintiff and not with any third party, including Pancoast. No third-party licensing agreements were ever entered into for license of Globecon content to non-clients.

38. During his long affiliation with plaintiff and Old Globecon, defendant Pancoast had extensive access to plaintiff's sensitive and confidential plaintiff client lists, client contacts, sales databases, instructors, content and other confidential and/or proprietary information relating to the business of plaintiff.

39. Upon information and belief, defendant Intuition hired defendant Pancoast following his termination of employment with plaintiff, in or about September 2003.

40. Upon learning that Pancoast was hired by Intuition, Plaintiff immediately sent both defendants a cease and desist notice, informing them they were in breach of the Employment Agreement, CIPNCA and the Restrictive Covenant, detailing each breach to defendants and reserving rights as against each.

41. Several months later, in or about December 2003, plaintiff was informed in London that defendant Pancoast was invited at the last minute to bid for business already promised to plaintiff by a long-time client. That last minute invitation caused a 6-month delay in closing of the contract between the client and plaintiff. During that 6-month delay, in early 2004, plaintiff was informed by various client contacts that defendant Intuition had recently "acquired a vast amount of advanced finance content," had been successful at greatly improving the sophistication of its materials "with remarkable speed" for both workshops and online distance education and that defendant Pancoast had become Intuition's Chief Learning Officer. Plaintiff's client informed it

that the reason for the delay was it was surprised at the high quality of defendant's "recently acquired" content, and had required time for additional consideration.

42. During the summer and fall of 2004, plaintiff learned from former employees of Old Globecon that defendant Intuition's "content acquisition" had in fact been reckless and brazen misappropriation of defendant's proprietary intellectual property by defendants. These individuals highlighted for plaintiff a vast array of plaintiff's own proprietary content which had been misappropriated by defendant Pancoast through "copy and paste" into Pancoast's letterhead stationary as "Market Abilities Unlimited."

43. In and around the same time, plaintiff held meetings with one or more independent instructors in Germany and first learned that Pancoast had for some period of time been marketing "a vast library of high end finance content" purported to be his own. Upon information and belief, such content was misappropriated from plaintiff by Pancoast.

44. By early 2005, plaintiff's strong factual information regarding the theft of its intellectual property by Pancoast was further confirmed when the founder and CEO of XGGL informed plaintiff by affidavit, as follows:

> Pancoast ran our European operation until 1995 and then established his own business. I state affirmatively that his authority to use materials of Old Globecon were limited to use in the ordinary course of business in instruction, and not to sale or any other disposition. Those rights to use the materials terminated in 1995 with his departure from Old Globecon, other than his rights to use said material as an instructor on behalf of Old Globecon, in the normal course of business and under the Globecon brand and copyright with Globecon's direct clients for the period commencing in or around 1999 and ending on or before the sale of Old Globecon assets to New Globecon.

> No valid enforceable agreements existed whereby Old Globecon directly assigned, sold or transferred license rights to any former employee, contractor or agent of any intellectual property of Globecon, including Pancoast, regardless of whether that intellectual property was developed by a full-time or part-time employee, agent or independent contractor. Further, no valid enforceable agreements existed whereby any of the Old Globecon's intellectual property was co-ventured, co-owned or otherwise co-held by Old Globecon and any third party.

45. In late 2006, plaintiff was provided samples of defendant Intuition's online distance education courses. Such samples confirmed, again, intellectual property theft and misappropriation by defendants Intuition and Pancoast.

46. At no time was Pancoast or any other consultant or employee granted any right, title or interest to plaintiff's proprietary materials. In fact, all employees and consultants employed at Old Globecon and plaintiff have been engaged consistently on a 'work-for-hire' basis.

47. Pursuant to the CIPNCA, defendant Pancoast agreed to the following, among other things:

> [He] will not, without Globecon's prior written permission, disclose to anyone outside of Globecon and its subsidiaries or use in other than Globecon's and its subsidiaries' business, either during or after [his] employment, any confidential information or material of Globecon or its subsidiaries, or any information or material received in confidence from third parties such as suppliers or customers, by Globecon or its subsidiaries. If [he] leave[s] the employ of Globecon, [he] will return to Globecon all property in [his] possession, whether or not containing confidential information, including but not limited to diskettes and other storage media, drawings, notebooks, reports, and other documents belonging to Globecon or its subsidiaries or received from any third party by Globecon or any of its subsidiaries.

48. Defendant Pancoast also agreed to the following clause within the Restrictive Covenant:

a) If I breach any of the restrictive covenants set forth in this Attachment A (the "Restrictive Covenants"), Globecon shall have the following rights and remedies, each of which shall be independent of the others and severally enforceable, and each of which is in addition to, and not in lieu of, any other rights and remedies available to Globecon at law or in equity:

i. I shall be immediately required to disclose, account for and pay over to Globecon all actual compensation, profits, monies, and accruals derived or received by me as a result of any action or transactions constituting a breach of any of the Restrictive Covenants. If Globecon, in its sole and absolute discretion, is not satisfied as to the timeliness and/or accuracy of the disclosure, accounting and/or payment made to it, Globecon will notify me in writing and shall have the unfettered right to notify any and all entities to which I become associated of the terms of this agreement, and I hereby do grant to Globecon the right to direct those entity(ies) to disclose directly to Globecon the information it needs to determine all actual compensation, profits, monies, and accruals derived or received by me as a result of any action or transactions constituting a breach of any of the Restrictive Covenants.

ii. Notwithstanding the provisions of Attachment A hereof, I acknowledge and agree that in the event of a violation or threatened violation of any of the Restrictive Covenants, Globecon shall have no adequate remedy at law and shall therefore be entitled to enforce each provision by temporary or permanent injunctive or mandatory relief obtained in any court of competent jurisdiction without the necessity of proving damages, posting any bond or other security, and without prejudice to any other rights and remedies which may be available at law or in equity.

iii. If any of the Restrictive Covenants, or any part thereof, is held to be invalid or unenforceable, the same shall not affect the remainder of the covenant or covenants, which shall be given full force and effect, without regard to the invalid or unenforceable portions.

iv. If any of the Restrictive Covenants, or any part thereof, is held to be unenforceable because of the duration of such provision or the area covered thereby, the parties hereto agree that the court making such determination shall have the power to reduce the duration and/or area of such provision and, in its reduced form, such provision shall then be enforceable.

49. Importantly, the contractual rights under the Restrictive Covenant granted to plaintiff, as cited above, include the "unfettered right to notify any and all entities to which [Pancoast] become[s] associated of the terms of [the Restrictive Covenant], and [defendant Pancoast] hereby do grant to [plaintiff] Globecon the right to direct those entity(ies) to disclose directly to [plaintiff] Globecon the information it needs to determine all actual compensation, profits, monies, and accruals derived or received by [defendants Intuition and Pancoast] as a result of any action or transactions constituting a breach of any of the Restrictive Covenants."

50. Additionally, the Restrictive Covenant, confirms "in the event of a violation or threatened violation of any of the Restrictive Covenants, Globecon shall have no adequate remedy at law and shall therefore be entitled to enforce each provision by temporary or permanent injunctive or mandatory relief obtained in any court of competent jurisdiction without the necessity of proving damages, posting any bond or other security, and without prejudice to any other rights and remedies which may be available at law or in equity."

51. Defendant Pancoast voluntarily terminated his employment with plaintiff on or about April 10, 2003. Immediately, or shortly thereafter, defendants Intuition and Pancoast conspired to breach and did breach the Employment Agreement and CIPNCA, as well as to subvert the copyright laws of the United States.

52. During the fall of 2006, plaintiff learned that defendants Intuition and Pancoast had successfully sold services and licensed content defendants purport to be its own to several key clients of plaintiff. It was further informed that a key issue was that "amazingly high quality" of the content defendants' alleged to own. From one client

alone, plaintiff lost a $350,000 annual contract to defendants. Defendants' theft of plaintiff's intellectual property and unfair competitive practices has and continues to cost plaintiff many millions of dollars in lost revenues annually.

The Content

53. Upon information and belief, defendant Pancoast maintained a copy of plaintiff's proprietary databases on computers he owned and used for distribution in print, online education, workshops and other forms. These proprietary databases contain many thousands of pages of plaintiff's content. Upon his termination from employment with plaintiff Pancoast failed to comply with the CIPNCA. He did not "return to [plaintiff] all property in [his] possession, whether or not containing confidential information, including but not limited to diskettes and other storage media, drawings, notebooks, reports, and other documents belonging to [plaintiff] or its subsidiaries or received from any third party by [plaintiff] or any of its subsidiaries," as provided for in the CIPNCA.

54. Upon information and belief, defendants Intuition and Pancoast conspired to breach and did breach the Employment Agreement and CIPNCA. Intuition immediately hired Pancoast as either a full-time employee or consultant in the role of "Chief Learning Officer" notwithstanding the fact Intuition knew, should have known, or should have inquired as is custom and practice in the industry, whether, as a former senior executive employed by plaintiff, Pancoast had entered into an employment agreement with plaintiff, and whether that agreement contained any restrictive covenants.

55. Upon or very shortly after his termination of employment with plaintiff, defendants Intuition and Pancoast conspired to subvert the copyright laws of the United States. Intuition hired Pancoast as either a full-time employee or consultant because, in fact, Pancoast had access to plaintiff's proprietary materials and proprietary databases.

56. Upon information and belief, prior to, contemporaneously with, or very shortly after his termination of employment with plaintiff, defendant Pancoast presented plaintiff's content to third parties, including defendant Intuition, claiming and holding same out to the world to be Pancoast's copyrighted works.

57. Annexed hereto as Exhibit "C" is a sample of plaintiff's copyright proprietary content entitled "Bond Futures" prepared in or around 1994; annexed hereto as Exhibit "D" is material now presented by defendant Pancoast as his own, entitled "Bond Futures". Defendant Pancoast's Exhibit "D", pp. 25 *et seq.* is virtually a verbatim copy of plaintiff's Exhibit "C", pp. 4 *et seq.* except for updated tables.

58. Annexed hereto as Exhibit "E" is a sample of plaintiff's copyright proprietary content entitled "Relative Value Concepts", prepared in or around 1995; annexed hereto as Exhibit "F" is material now presented by defendant Pancoast as his own, entitled "Relative Value Trading Strategies". Defendant Pancoast's Exhibit "F", pp. 2 *et seq.* is virtually a verbatim copy of plaintiff's Exhibit "E", pp. 3 *et seq.* except for updated tables.

59. Annexed hereto as Exhibit "G" is a sample of plaintiff's copyright proprietary content entitled "Option Book Management", prepared in or around 1995; annexed hereto as Exhibit "H" is material now presented by defendant Pancoast as his

own, entitled "Managing Interest Rate Option Risk". Defendant Pancoast's Exhibit "H", pp. 2 *et seq.* is virtually a verbatim copy of plaintiff's Exhibit "G", pp. 19 *et seq.*

60. Annexed hereto as Exhibit "I" is a sample of plaintiff's copyright proprietary content entitled "LIBOR-in-Arrears Swaps", prepared in or around 1994; annexed hereto as Exhibit "J" is material now presented by defendant Pancoast as his own, entitled "Libor/Euribor-in-Arrears". Defendant Pancoast's Exhibit "J", pp. 1 *et seq.* is virtually a verbatim copy of plaintiff's Exhibit "I", pp. 2 *et seq.* except for updated tables and examples.

61. Plaintiff has possession of many such examples of misappropriation and theft of its proprietary intellectual property, and is aware, upon information and belief that a very significant number other such examples of misappropriation exist.

62. Upon information and belief, in or about December 2002, defendant Intuition and plaintiff met (along with Pancoast, then an employee of plaintiff) in New York to discuss the possibility of collaboration, joint venture and/or merger. Documents written at the time of that meeting confirm that Intuition expressed clear need to acquire the significantly higher quality content owned by Plaintiff and to use plaintiff's reputation, skills, client relationships and workshop content to enter the workshop business in the banking and financial services sectors.

63. No such collaboration, joint venture and/or merger was ever consummated.

64. Shortly thereafter on or about April 10, 2003, defendant Pancoast resigned from plaintiff and with defendant Intuition conspired to breach and did breach the Employment Agreement, the CIPNCA and the Restrictive Covenant, as well as to

misappropriate plaintiff's content and subvert the copyright laws of the United States. In or about the summer of 2004, Plaintiff would first learn that the misappropriation of its content occurred.

65. Upon information and belief, at some time following the December 2002 meeting of the parties, defendant Pancoast advised defendant Intuition that he could provide substantial content to defendant Intuition that would enable Intuition to more effectively compete with plaintiff. Defendant Pancoast had expressed significant upset and disappointment that a collaboration, joint venture and/or merger was never made between Intuition and Globecon.

66. Upon information and belief, defendant Intuition knew or should have known that Pancoast intended to provide it with the proprietary content copied from the plaintiff. Upon information and believe, Intuition willfully interfered with plaintiff's contractual relationship with Pancoast because it believed that plaintiff would not learn of the theft and misappropriation of the intellectual property and its proprietary databases.

67. Upon information and belief, defendant Intuition hired defendant Pancoast as an employee or retained Pancoast as a consultant for the purposes of converting and misappropriating plaintiff's content and customer lists.

68. Upon information and belief, defendant Intuition is using intellectual property content copied from the plaintiff by defendant Pancoast in connection with its distance education system and newly formed workshop business within the banking, financial services and insurance sectors.

69. Upon information and belief, defendants Pancoast and/or Intuition thereafter presented copies of plaintiff's content to third parties and utilized same in connection with their distance education system and newly formed workshop business, claiming plaintiff's content to be their own.

70. Upon information and belief, defendant Pancoast disclosed to defendant Intuition plaintiff's clients and sales databases, the names and contact information of plaintiff's clients, the names and contact information of plaintiff's instructors and other confidential and/or proprietary information belonging to plaintiff.

71. Upon information and belief, defendants Pancoast and Intuition are soliciting and obtaining the benefits of business from plaintiff's clients.

72. Plaintiff Globecon has been advised by one or more of its clients and instructors that defendant Pancoast, on behalf of defendant Intuition sought and solicited and continues to seek and solicit the business of Globecon's clients for and on behalf of himself and defendant Intuition, and defendants Pancoast and Intuition have accepted and are accepting business from Globecon's clients.

73. Upon information and belief, defendant Pancoast provided defendant Intuition with other proprietary, copyrighted and/or confidential material related to plaintiff's training and educational programs.

74. Defendant Pancoast further refused and continues to refuse to return proprietary databases, and used those databases and contact information to solicit business in direct contravention of the CIPNCA.

75. Upon information and belief, defendant Intuition accepted such confidential and/or copyrighted information and materials from defendant Pancoast, and

knew or should have known that such material was the confidential and proprietary information belonging to plaintiff Globecon.

FIRST CLAIM FOR RELIEF

76. Plaintiff, in the course of its business, authored certain intellectual property, including educational and business materials utilized and to be utilized in its conferences, seminars, workshops online distance education business and other professional development services within the banking and financial services sectors.

77. Plaintiff is the sole proprietor of all rights, title, and interest in and to the above-described intellectual property. All of its content had and continues to bear appropriate copyright and intellectual property notices at all times relevant hereto.

78. Certain of the above-described intellectual property as set forth in Exhibit "M" annexed hereto was duly registered with the United States Copyright Office on the dates referenced in said Exhibit. Plaintiff complied in all respects with the Title 17 (Copyrights), Chapter 4 of the United States Code, all rules, codes and regulations promulgated thereunder, and all other laws governing copyright, and secured the exclusive rights and privileges in and to the copyright of said material identified in the annexed Exhibit "M", and received from the Register of Copyrights certificates of registration, dated and identified as indicated in the annexed Exhibit "M".

79. Upon information and belief, following defendant Pancoast's termination of employment with plaintiff in or about April, 2003 and his hiring by defendant Intuition, defendants Pancoast and/or Intuition, upon information and belief, began reproducing, adapting, distributing, and utilizing plaintiff's copyrighted intellectual property, including, upon information and belief, the duly registered materials set forth in

the annexed Exhibit "M" in connection with its online distance education business, workshops and other professional development services within the banking, financial services and insurance sectors, in direct competition with plaintiff.

80. Annexed hereto as Exhibit "C" is a sample of plaintiff's copyright proprietary content entitled "Bond Futures" prepared in or around 1994; annexed hereto as Exhibit "D" is material now presented by defendant Pancoast as his own, entitled "Bond Futures". Defendant Pancoast's Exhibit "D", pp. 25 *et seq.* is virtually a verbatim copy of plaintiff's Exhibit "C", pp. 4 *et seq.* except for updated tables.

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83. Annexed hereto as Exhibit "I" is a sample of plaintiff's copyright proprietary content entitled "LIBOR-in-Arrears Swaps", prepared in or around 1994; annexed hereto as Exhibit "J" is material now presented by defendant Pancoast as his own, entitled "Libor/Euribor-in-Arrears". Defendant Pancoast's Exhibit "J", pp. 1 *et seq.*

is virtually a verbatim copy of plaintiff's Exhibit "I", pp. 2 *et seq.* except for updated tables and examples.

84. The materials provided for in Exhibit "C", "E", "G", and "I" represent only a fraction of plaintiff's proprietary material that defendants have infringed and misappropriated.

85. Annexed hereto as Exhibit "K" is a sample of plaintiff's online course titles which were in existence since 2002; and, annexed hereto as Exhibit "L" is sample that defendant Intuition's course titles that it lists on its web sites. The addition of Intuition courses of near or identical titles to Globecon courses correspond directly to employment of defendant Pancoast by defendant Intuition; the breach of the Employment Agreement, CIPCNA and Restrictive Covenant by Pancoast; the tortuous interference by Intuition with plaintiff's contractual relationship with Pancoast; and the misappropriation of plaintiff's intellectual property by defendants. Upon information and belief, defendant Intuition's courses utilize proprietary information belonging to plaintiff.

86. Unless enjoined and restrained, defendants' conduct threatens to further infringe plaintiff's copyright interests.

87. At no time has plaintiff authorized defendants to reproduce, adapt, distribute or in any way utilize the said copyrighted material.

88. Plaintiff has notified defendants that defendants have infringed the copyrights of plaintiff, and defendants have continued to infringe the copyrights.

89. By reason of defendants' infringement and threatened infringement, plaintiff has sustained and will continue to sustain substantial injury, loss and damage to its ownership rights in the copyrighted works.

90. Further irreparable harm to plaintiff is imminent as a result of defendants' conduct, and plaintiff is without an adequate remedy at law. Plaintiff is therefore entitled to an injunction restraining defendants Pancoast and Intuition, together with its officers, directors, agents, employees, representatives and all persons acting in concert with them from engaging in further such acts of copyright infringement.

91. Plaintiff is further entitled to recover from defendants the damages sustained by plaintiff as a result of defendants' acts of copyright infringement. Plaintiff is at present unable to ascertain the full extent of the monetary damage plaintiff has suffered by reason of defendant's acts of copyright infringement, but plaintiff is informed and believes, and on the basis of such information and belief alleges, that plaintiff has sustained such damage in an amount exceeding $ 10,000,000.

92. Plaintiff is further entitled to recover from defendants the gains, profits and advantages they have obtained as a result of their acts of copyright infringement. Plaintiff is at present unable to ascertain the full extent of the gains, profits and advantages defendants have obtained by reason of their acts of copyright infringement, but plaintiff is informed and believes, and on the basis of such information and belief alleges, that defendants has obtained such gains, profits and advantages in an amount exceeding $10,000,000.

SECOND CLAIM FOR RELIEF

93. Plaintiff repeats and realleges the allegations set forth above as though fully set forth herein.

94. As a result of the foregoing, defendants have thereby been engaging in unfair trade practices against plaintiff to plaintiff's irreparable damage.

95. Plaintiff has no adequate remedy at law.

THIRD CLAIM FOR RELIEF

96. Plaintiff repeats and realleges the allegations set forth above as though fully set forth herein.

97. Defendant Pancoast's conduct constitutes continuing breaches of the CIPNCA.

98. As a result of defendant Pancoast's breaches of the CIPNCA, plaintiff has incurred substantial damages, including the loss of clients, and loss of reputation and goodwill.

FOURTH CLAIM FOR RELIEF

99. Plaintiff repeats and realleges the allegations set forth above as though fully set forth herein.

100. The CIPNCA constitutes a valid and enforceable contract between plaintiff and defendant Intuition.

101. Defendant Intuition, at the time of the inception of its relationship with defendant Pancoast knew or should have known of the CIPNCA between plaintiff and defendant Pancoast, including the restrictive covenants and confidentiality provisions contained therein.

102. Defendant Intuition, at the time of the inception of its relationship with defendant Pancoast knew or should have known that plaintiff was the sole proprietor of the copyright for the content material provided to it by defendant Pancoast. Defendant

Intuition knew or should have known that it would have been impossible for defendant create the volume of content he possessed without copyright infringement, and knowingly ignored this fact because of its strong need to improve the content of its online distance education business and to enter into the workshop business.

103. Defendant Intuition intentionally interfered with the CIPNCA between plaintiff and defendant by employing defendant in its business of providing training, publications and other professional development services to banks and financial institutions, by facilitating defendant Pancoast's solicitation of plaintiff Globecon's clients and employees while employed by defendant Intuition, and by soliciting and accepting business from Globecon's clients, all notwithstanding its actual and/or constructive knowledge of the CIPNCA.

104. Defendant Intuition's interference with the CIPNCA and plaintiff's prospective economic advantage resulted in breaches of the CIPNCA by defendant Pancoast and caused plaintiff to incur substantial damages, including the loss of clients, and loss of reputation and goodwill.

FIFTH CLAIM FOR RELIEF

105. Plaintiff repeats and realleges the allegations set forth above as though fully set forth herein.

106. Upon information and belief, defendants have taken sensitive, proprietary, copyrighted, and/or confidential matter belonging to plaintiff, and have utilized it for their own purposes without right or permission.

107. Defendants' acts constitute unfair competition against plaintiff and the unlawful appropriation by defendants of plaintiff's proprietary, copyrighted, and/or confidential business information and intellectual property.

108. Defendants' interference with plaintiff's prospective economic advantage caused plaintiff to incur substantial damages, including the loss of clients, and loss of reputation and goodwill.

109. As a result of defendants' unfair competition, plaintiff has incurred substantial damages, including the loss of clients, and loss of reputation and goodwill.

SIXTH CLAIM FOR RELIEF

110. Plaintiff repeats and realleges the allegations set forth above as though fully set forth herein.

111. Defendants' acts constitute unfair competition against plaintiff, and the unlawful appropriation by defendants of plaintiff's proprietary, copyrighted, and/or confidential business information.

112. Section C of the Restrictive Covenants annexed to the CIPNCA entitles plaintiff to a temporary or permanent injunction to enforce the terms thereof without the necessity of proving damages, posting a bond or other security and without prejudice to any other rights or remedies available at law or in equity.

113. This Section C also requires defendant Pancoast immediately "to disclose, account for and pay over to Globecon all actual compensation, profits, monies, and accruals derived or received by me as a result of any action or transactions constituting a breach of any of the Restrictive Covenants."

114. This Section C also states that if "Globecon, in its sole and absolute discretion, is not satisfied as to the timeliness and/or accuracy of the disclosure, accounting and/or payment made to it, Globecon will notify [Pancoast] in writing and shall have the unfettered right to notify any and all entities to which [Pancoast] become[s] associated of the terms of this agreement, and I hereby do grant to Globecon the right to direct those entity(ies) to disclose directly to Globecon the information it needs to determine all actual compensation, profits, monies, and accruals derived or received by me as a result of any action or transactions constituting a breach of any of the Restrictive Covenants."

115. Unless restrained and enjoined, defendants' unfair competition and misappropriation will continue, causing plaintiff to suffer further irreparable and incalculable harm.

116. Plaintiff has no adequate remedy at law.

SEVENTH CLAIM FOR RELIEF

117. Plaintiff repeats and realleges the allegations set forth above as though fully set forth herein.

118. Section C of the Restrictive Covenants annexed to the CIPNCA also requires defendant Pancoast immediately "to disclose, account for and pay over to Globecon all actual compensation, profits, monies, and accruals derived or received by me as a result of any action or transactions constituting a breach of any of the Restrictive Covenants."

119. Upon information and belief, defendant Pancoast received actual

compensation, profits, monies, and accruals derived or received by him as a result of actions or transactions constituting a breach of one or more of the Restrictive Covenants set forth in the CIPNCA.

120. Upon an accounting by the defendants, there will be found due to the plaintiff from the defendants a large sum of money the amount of which is not known to the plaintiff.

121. Heretofore and prior to the commencement of this action, plaintiff duly demanded of defendant Pancoast that he account for his acts as in connection with defendants' receipt of money resulting from the breach of the CIPNCA, and that he pay over to plaintiff all amounts due plaintiff under the aforesaid agreement, but the defendant Pancoast, having a duty to account to plaintiff, has failed and refused to do so and has never rendered an accounting for the moneys received under said agreement nor paid over to plaintiff any of such moneys due it.

122. The plaintiff has no adequate remedy at law.

WHEREFORE, plaintiff demands judgment against defendants as follows:

1. On the first, second and sixth claims for relief, for a preliminary and permanent injunction enjoining the defendants, and their agents, representatives, employees and anyone acting for or in concert with them or on their behalf, from:

    a. manufacturing, reproducing, distributing, adapting, displaying, advertising, promoting, utilizing, or offering for sale and/or selling, any materials that are substantially similar to the copyrighted works, and to deliver to the Court for destruction or other reasonable disposition all such materials and means for producing same in defendant's possession or control;

b. directly or indirectly soliciting or aiding or abetting the solicitation of any client of the plaintiff or any person, party or entity who was a client of the plaintiff during the last years of defendant Pancoast's employment with the plaintiff;

c. directly or indirectly interfering with the plaintiff's business relationships with its clients and the plaintiff's negotiations and outstanding contracts with its clients;

d. directly or indirectly communicating with or contacting clients of the plaintiff or any persons, parties or entities who were clients of the plaintiff during the last years of the employment of defendant Pancoast with the plaintiff;

e. directly or indirectly divulging to any person, party or entity the names of any of the plaintiff's clients, the plaintiff's methods of client solicitation, the plaintiff's clients' needs and natures, the plaintiff's business information, documents, records, techniques, ideas, writings, forms, working methods, pricing, caliber of individual employees and other information not generally known to the public or competitors of the plaintiff, or any other proprietary or confidential business information of the plaintiff;

f. using, in any manner, the plaintiff's client information and data and any other proprietary or confidential information obtained from the plaintiff;

g. Directing the defendants to return to the plaintiff all of the plaintiff's proprietary and confidential business records, documents, information and data in their possession or subject to their custody or control, including, *inter*

alia, any client lists and copies thereof, and to remove any and all copies of such information from its records;

h. directly or indirectly referring to the plaintiff or to the relationship of defendant Pancoast with the plaintiff in connection with the solicitation of clients by the defendants; and

i. awarding the plaintiff compensatory damages and/or punitive damages including defendant's profits in an amount to be determined at the trial thereof, plus interest thereon.

2. On the first and second claims for relief, that defendants be required to pay to plaintiff such damages as plaintiff has sustained in consequence of defendants' infringement of said copyright and said unfair trade practices and unfair competition and to account for (a) all gains, profits and advantages derived by defendant by said trade practices and unfair competition and (b) all gains, profits, and advantages derived by defendant by his infringement of plaintiff's copyright or such damages as to the court shall appear proper within the provisions of the copyright statutes, but not less than TEN MILLION ($10,000,000.00) DOLLARS, together with interest thereon;

3. On the third, fourth and fifth claims for relief, awarding the plaintiff statutory, compensatory damages and/or punitive damages in an amount to be determined at the trial thereof, plus interest thereon,

4. On the sixth and seventh claims for relief, directing the defendants to account to the plaintiff for all moneys and property received by the defendants under the CIPNCA

as aforesaid and adjudging that the plaintiff have judgment against the defendant Pancoast for any sums found to be due plaintiff from said defendant;

5. Awarding plaintiff its reasonable attorney's fees and costs; and

6. Awarding the plaintiff such other and further relief as to the Court may seem just, proper and equitable, together with the costs and disbursements of this action.

Dated: White Plains, New York
April 9, 2007

Eric J. Rotbard

ERIC J. ROTBARD, ESQ. (ER0750)
Attorney for Plaintiff
81 Main Street, Suite 205
White Plains, New York 10601
(914) 422-2500

JURY DEMAND

The plaintiff hereby demands a trial by jury as to all issues involved in this action.

Dated: White Plains, New York
April 9, 2007

Eric J. Rotbard

ERIC J. ROTBARD, ESQ. (ER0750)
Attorney for Plaintiff
81 Main Street, Suite 205
White Plains, New York 10601
(914) 422-2500

Exhibit C

Bond Futures

For information contact:

The Globecon Group, Ltd.
71 Murray Street, 10th fl.
New York, NY 10007
(212) 608-1160 phone
(212) 227-0443 fax

BOND FUTURES CONTRACTS

A. Introduction and Overview of Contracts

There are many different futures contracts today covering changes in the value of government bonds. The oldest and most prominent in terms of liquidity refer to U.S. Treasury bonds. But government bond futures now exist for nearly every liquidly traded government bond market. For a complete list, please see the appendix attached at the end of this guide.

Features which all government bond futures contracts have in common include contracts for the longest maturities of actively issued government bonds, specific deliverable bonds, and tick values equal to the smallest price change of the underlying bonds themselves.

Government bond futures contracts are used by portfolio managers, bond traders, long-term interest rate speculators, swap book managers, and bond issuers and underwriters. Government bond futures are also used to hedge the risk of eurobonds, corporate bonds, and other forms of long-term debt, to varying degrees of success. The fact is that there is often little correlation among government bond rates and other bond rates in the same currency over short periods of time, like a trading day or two. Over longer periods of time, long-term rates in the same currency seem to move more or less in tandem. Over shorter periods, however, the spreads separating them can change dramatically, destroying well-calculated hedge ratios and turning *hedges* into additional *positions*.

Users of Long Term Interest Rate Futures

Managing Pension Funds

One of the main users of long term interest rate futures contracts are pension fund managers. These managers are responsible for creating an asset portfolio whose value coincides with or exceeds the value of a given schedule of liabilities (anticipated payouts to retirees), and whose duration or interest rate sensitivity is the same as the liabilities. Fund managers refer to this as *immunizing* their liabilities against a certain range of interest rate movements.

Locking In Cost Of Debt Issuance

Very often corporations know in advance that they will be issuing debt at some point in the near future. One example would be future project funding. The corporation could issue the debt today and invest the proceeds until such time that the funds are actually required. By using the interest rate futures contract the risk free component of the issuance can be locked in.

The corporation would sell futures contracts. If interest rates rose between now and the time of debt issuance, the cost of the debt would increase. However this would be offset

by a gain on the futures transaction. When the company closes its futures position the price will have fallen due to an increase in yields. This gain could be used to offset the increased expense on the debt.

Locking In Value Of An Asset

If a firm has an asset (bond) that they know they will want to sell in the future and the view is that interest rates are going to increase between now and the time of anticipated sale, by using the futures market the value of the asset at sale can be locked in. The bond could be sold today and the proceeds reinvested but this may not be feasible. An upcoming coupon payment may be desirable. The firm may want to wait for rates to rise before investing again.

In this case a long-term interest rate future would be sold. If rates increased the value of the asset would decline. This would be offset by a gain in the futures contracts. As rates increased the price of the futures would fall and the contract could be closed out at a gain.

Bond Traders

The long term interest rate futures add another tool to the bond trader's portfolio. They can be used to hedge an existing portfolio or adjust the duration of the existing portfolio. Traders can adjust their view and the portfolio's position quickly by using the futures market.

B. Contract Specifications

This guide will use two well-known futures contracts to explore how bond futures work, Treasury bond futures and *Bund* futures. While there are many others which are just as useful and just as interesting, the terms and functioning of bond futures contracts are fairly homogenous from exchange to exchange, so the two selected will prove representative around the world.

Bonds issued by the government of the United States are called United States Treasury bonds, and are often referred to simply as "Treasuries." Bonds issued by the government of Germany are called "*Anleihe der Bundesrepublik Deutschland*", referred to as *Bunds*, "*Anleihe der Bundesrepublik Deutschland — Fonds Deutsche Einheit*", referred to as German unity bonds, and "*Anleihe der Treuhandanstalt*", referred to as *Treuhand* bonds. All three types of German government bonds are included in *Bund* futures. *Bundesrepublik* means the Federal Republic, so calling German government bonds *Bunds*, means we are calling them *Federals*.

U.S. Treasury bond futures contracts are traded on the Chicago Board of Trade (CBOT) and several other exchanges, including the London International Financial Futures and Options Exchange (LIFFE). *Bund* futures contracts are traded on LIFFE and on the Deutsche Termin Börse (DTB). Specifications for these bond futures contracts follow.

	Treasury Bond	*10-Year Treasury Note*	*Bund*
Trading Unit	One U.S. Treasury bond having a face value at maturity of $100,000 or multiple thereof	One U.S. Treasury note having a face value at maturity of $100,000 or multiple thereof	DM250,000 nominal value German Government Bond (*Bund*)
Notional Tenor	30 years	10 years	10 years
Theoretical Coupon:	8%	8%	6%
Deliverable Bonds	U.S. Treasury bonds that have a maturity (or a first callable date) of at least 15 years from the first business day of the delivery month.	U.S. Treasury notes that have a maturity of at least 6½ years, but not more than 10 years, from the first business day of the delivery month.	German government bonds (as defined above) with 8½-10 years remaining maturity as at the 10th calendar day of the delivery month.
Price Quote	Points ($1,000) and thirty-seconds of a point	Points ($1,000) and thirty-seconds of a point	Percent of nominal value to two decimal points
Tick Size	1/32 of a point ($31.25)	1/32 of a point ($31.25)	0.01 (DM25)
Daily Price Limit	3 points ($3,000); lifted the 2nd business day before the 1st day of the delivery month.	3 points ($3,000); lifted the 2nd business day before the 1st day of the delivery month.	None
Contract Months	Mar, Jun, Sep, Dec	Mar, Jun, Sep, Dec	Mar, Jun, Sep, Dec
Delivery Day	Last business day of contract month	Last business day of contract month	10th calendar day of contract month
Last Trading Day	7th Chicago business day before delivery day	7th Chicago business day before delivery day	3 Frankfurt working days prior to delivery day

C. Bond Futures Prices

Deliverable Bonds

The list of bonds which fits the description given above for each contract changes from time to time as new bonds are issued and as older bonds become shorter than the minimum maturity described above.

In general terms, bonds which are cheaper to buy are also the cheaper bonds to deliver against the futures contract. The cheapest bond to deliver also changes from time to time, normally as a function of changing bond yields or a change in the slope of the yield curve.

Bonds which are deliverable but not generally desired by bond investors tend to move up the list of cheapest to deliver bonds because their prices are discounted in the cash bond

market. Under current market conditions (long-term interest rates at historical cyclical lows) this is true for bonds issued earlier, which have very high coupons. In a few years, when long-term yields have risen again, bonds being issued now will be available at a discount in the cash market, and so will likely remain somewhat more desirable.

When bond yields are low, as they are in late 1993, bonds with shorter modified duration (henceforth referred to simply as *duration*) tend to be cheaper to deliver. This is because market prices for shorter duration bonds rise relatively less than market prices for longer duration bonds as rates fall. Higher coupons shorten duration. Thus, the cheapest to deliver bonds when yields in the market are low will be those bonds with the highest coupons. This is clearly evident with the deliverable bonds into the long Treasury bond contract on the CBOT.

As of November 1993, the list of deliverable bonds for the March 1994 Treasury bond futures contract stood as follows:

Deliverable Bonds, CBOT Treasury Bond Futures, March 1994

Bond	Coupon	Maturity	Market Price	Yield	Modified Duration	Conversion Factor
Treasury	11 3/4	15/11/2009	156 19/32	6.1436%	8.8916	1.3298
Treasury	13 1/4	15/5/2009	171 13/32	6.0737%	8.5605	1.4539
Treasury	12 1/2	15/8/2009	164 3/32	6.1050%	8.5638	1.3921
Treasury	11 1/4	15/2/2015	156 13/32	6.3680%	10.2078	1.3262
Treasury	10 5/8	15/8/2015	149 1/2	6.3823%	10.4223	1.2659
Treasury	9 7/8	15/11/2015	140 25/32	6.3956%	10.7908	1.1910
Treasury	9 1/4	15/2/2016	133 13/32	6.4097%	10.7838	1.1277
Treasury	8 3/4	15/5/2017	127 7/8	6.4335%	11.3486	1.0783
Treasury	8 7/8	15/8/2017	129 7/16	6.4375%	11.1842	1.0915
Treasury	9 1/8	15/5/2018	132 29/32	6.4374%	11.4776	1.1192
Treasury	7 1/2	15/11/2016	112 5/8	6.4402%	11.5586	0.9482
Treasury	7 1/4	15/5/2016	109 21/32	6.4320%	11.5242	0.9229
Treasury	8 7/8	15/2/2019	130 1/16	6.4465%	11.4873	1.0935
Treasury	9	15/11/2018	131 23/32	6.4322%	11.6118	1.1067
Treasury	8 1/8	15/8/2019	120 23/32	6.4617%	11.7525	1.0133
Treasury	8 1/2	15/2/2020	125 21/32	6.4569%	11.7578	1.0540
Treasury	8 3/4	15/5/2020	129	6.4517%	11.9462	1.0816
Treasury	8 3/4	15/8/2020	129 1/16	6.4533%	11.7952	1.0816
Treasury	8 1/8	15/5/2021	121 11/32	6.4562%	12.2737	1.0137
Treasury	7 7/8	15/2/2021	118	6.4610%	12.0927	0.9861
Treasury	8 1/8	15/8/2021	121 3/8	6.4578%	12.1169	1.0136
Treasury	8	15/11/2021	120 1/32	6.4457%	12.4015	1.0000
Treasury	7 5/8	15/11/2022	115 17/32	6.4360%	12.6771	0.9581
Treasury	7 1/4	15/8/2022	110 15/32	6.4443%	12.5363	0.9163
Treasury	7 1/8	15/2/2023	109 15/32	6.4036%	12.6922	0.9019
Treasury	6 1/4	15/8/2023	101 5/32	6.1638%	13.3184	0.8032

The bonds above are ranked in order of relative price, with the cheapest to deliver bond at the top of the list. Duration ranges from only 8.89 years for the cheapest to deliver to 13.3 years for the most recent long bond issued in August 1993. Duration appears to be the principal determinant of which bond is cheaper to deliver, due to the very low level of yields in the market. In addition, bonds with very high coupons (the first three bonds on the list were issued at the top of the interest rate cycle in 1984) trade at very high premiums above par. Many investors are loathe to spend 150% of par or more to buy a bond.

When bond yields are relatively high (above 8%), the reverse is true. Bonds with relatively longer duration will tend to be the cheaper bonds to deliver. The market prices of longer duration bonds tend to fall relatively faster than the market prices of shorter duration bonds as yields rise. They are thus relatively cheaper to buy and therefore cheaper to deliver.

Duration is not the only factor in determining which bonds are cheaper to deliver. Bonds' prices relative to each other are affected by other variables such as liquidity, whether a bond is callable, and perceived differential credit quality among eligible "government" issuers. In general, when bonds have the same duration, the bond with the higher yield will have the lower price, and therefore be cheaper to deliver. Its price is lower because it is less desirable to investors for one of the reasons listed above.

The list of deliverable bonds is much shorter for *Bund* futures, as the German government has in the past not needed to fund such large deficits as the U.S. government. Reunification has conspired to add a great deal of "liquidity" to the German government bond market however, and the list of deliverable bonds grows longer.

Coupon size and duration are a factor in the cheapest to deliver against *Bund* futures, too, but there is another factor of even greater importance. *Treuhand* bonds, issued by a German government guaranteed agency set up to fund the purchase and privatization of companies in the former East Germany, enjoy the full legal backing of the Federal Republic of Germany, and are thus deliverable into *Bund* futures contracts on LIFFE and DTB. But they are not held in equal esteem in the cash bond market, and normally trade at prices discounted slightly from *Bunds* so as to yield 10-15 basis points more. Since their prices are lower, they become cheaper to deliver almost automatically. The effects of duration and liquidity are the major differentiation among the seven *Treuhand* issues currently deliverable. *THA* stands for *Treuhand* bonds, and *DBR* stands for *Bunds*.

LIFFE *Bund* Futures, December 1993

Bond	Coupon	Maturity	Price	Yield	Modified Duration	Conversion Factor
THA	7 1/8	29/1/2003	107.363	6.0521%	6.3839	1.076897
THA	6 7/8	11/6/2003	105.894	6.0381%	6.7737	1.061493
THA	7 3/8	2/12/2002	109.050	6.0441%	6.1953	1.092700
THA	7 3/4	1/10/2002	111.613	6.0166%	6.4053	1.116075
THA	6 1/2	23/4/2003	103.425	6.0068%	6.7183	1.034535
THA	6 5/8	9/7/2003	104.363	6.0089%	6.8949	1.043798
DBR	7 1/8	20/12/2002	107.956	5.9626%	6.2951	1.076519
THA	6	12/11/2003	100.238	5.9670%	7.3390	0.999868
DBR	7 1/4	21/10/2002	108.800	5.9472%	6.5354	1.083526
DBR	6 3/4	22/4/2003	105.750	5.9290%	6.6834	1.051997
DBR	8	22/7/2002	113.706	5.9248%	6.2036	1.130619
DBR	6 1/2	15/7/2003	104.188	5.9121%	6.9477	1.035197
DBR	6	15/9/2003	101.152	5.8390%	7.2093	0.999674

The bonds above are also listed in order of relative price, with the cheapest to deliver at the top of the list. Again, the relatively higher coupon and relatively shorter duration are the predominant factors.

Determining which bond is the cheapest to deliver requires an understanding of where bond futures prices come from. To understand bond futures prices requires an understanding of cost of carry, repo rates and basis. Calculating the cheapest to deliver is based on these factors.

Cost of Carry

The price of bond futures is tied to the price of bonds in the cash market. As cash prices rise, futures prices also rise.

In simple terms, the futures price is determined in the following way. By borrowing the money to buy a bond today in the cash market, a person can sell it forward in the futures market. For example he might buy the 6% *Bund* (the very last bond listed above under DBR, *Deutsche Bundesrepublik*, due 15 September 2003) at its market price of 101.152% of par.

He would be content to sell it forward as long as he can receive a price higher than the price he has just paid.

Since he has to borrow the money to buy it, he will have to pay interest on the loan. This interest is known as *cost of carry*, and it normally increases the price of anything in the future. In this simple example, the cost of the interest is added to the cash market price in calculating the break-even price at which the bond must sell in the futures market.

With commodities, such as wheat, corn, or oil, cost of carry includes other items, such as transportation costs (the literal meaning of cost of carry is the cost to transport a commodity from the fields to the buyer), insurance, storage, etc.

With interest rate futures contracts, the primary cost of carry is interest expense. Other costs are brokerage fees, margin costs, and other transaction costs. The most important of these is interest expense.

Repo Rates

Repo rates are the usual interest expense for financing the purchase of a bond. Meaning the rate on a *repurchase agreement*, the repo rate is the market rate at which one can borrow money in order to purchase a bond in the cash market.

Mechanically, using a repo (a repurchase agreement) is very simple. As long as he has a good name and a telephone, a party can call a bond dealer and ask to buy a bond. The dealer will ask how he wants to pay for it, and he can tell him he wishes to "*repo it*." This means he wishes to borrow the money from the dealer to buy the bond. He will leave the actual bond in the dealer's safekeeping, but he will be the owner, and he will owe the dealer interest on the loan at an agreed market rate. This rate is the repo rate. At the maturity of the loan, he can pay back the loan and the interest, and take possession of the bond. Or he can simply sell the bond back to the dealer at the current market price, and settle for the difference against the loan principal plus interest.

In this case, imagine he intends to take possession of the bond by repaying the loan and interest in full. He intends to do this because he is going to sell the bond through the futures market.

Repo markets do not exist for every kind of government bond. Although there is a very liquid repo market in the United States, the use of repos is only just beginning in Germany, for example. Where there is no liquid repo market, the repo rate is equal to the short-term interbank rate (Libor, Pibor, Fibor, Hibor, Sibor, etc.) for the period remaining through the futures market delivery date.

Conversion Factors

When someone delivers a government bond to satisfy an existing short futures position, he sells it for the futures price agreed when the trade is done. There is only one futures price for each future delivery date, no matter which bond he intends to actually deliver.

Since the list of deliverable bonds contains a great diversity of coupon sizes and remaining maturities, the clearing house must use a conversion factor to make the prices of the different deliverable bonds more or less comparable.

The device used on most bond futures contracts, is to calculate a price at which the bond would yield the theoretical coupon rate of the futures contract, 8% for Treasury bond futures and 6% for *Bund* futures. This price is the bond's conversion factor. We will look at one example from each of the two contracts listed above.

Calculating a Conversion Factor

Issue:	Treasury	Treuhand
Maturity:	15-Nov-2009	29-Jan-2003
Coupon:	11 3/4	7 1/8
Market Price:	156 19/32	107.363
Conversion Factor:	1.3298	1.076897
Face Value:	$100,000	DM250,000

CBOT Treasury Bond Futures

The CBOT uses a convention for calculating the conversion factor which alters the actual maturity of the bond by forcing the maturity to an even number of calendar quarters. For example, the actual maturity of the 11 3/4% Treasury above is 15 November 2009 (this bond is callable at that date, and will otherwise mature in 2014). For purposes of calculating the conversion factor, the CBOT treats the first delivery day (the first business day of the delivery month) as the settlement date, 1 March 1994 for the March 1994 contract, and sets the bond's maturity at an even number of calendar quarters, as if it were 1 September 2009. Then a price is calculated which will yield the nominal coupon of 8%.

Example

The conversion factor of 1.3298 for the Treasury bond is calculated as follows using both the HP12C and the HP19B.

	Value	*Key*	*Display*
1) Clear financial registers and set		[f][REG]	0.0000
accuracy to 4 digits		[f][4]	

2) Enter 8% YTM	8	[i]	8.0000
3) Enter the coupon	11.75	[PMT]	11.7500
4) Enter the first day of the delivery month for the March 1994 futures contract	3.011994	[ENTER]	03.0120
5) Enter the adjusted maturity date and calculate the bond's price	9.012009	[f][PRICE]	132.9784
6) Divide by 100	100	[÷]	1.3298

This is the conversion factor listed by the CBOT of 1.3298.

The same calculation can be performed using the HP19B:

	Value	*Key*	*Display*
1) Set display to 4 digits		[DISP]	TO SET #DECIMAL PLACES: PRESS {FIX} OR {ALL}.
		[FIX]	TYPE #DIGITS (0-11); PRESS [INPUT]
	4	[INPUT]	
2) Choose the financial menu		[FIN]	SELECT A MENU
3) Choose the bond menu		[BOND]	A/A SEMIANNUAL
4) Set the type of bond to actual/actual semi-annual		[TYPE]	
		[A/A]	
		[SEMI]	A/A SEMIANNUAL
5) Exit back to the bond menu		[EXIT]	A/A SEMIANNUAL
6) Enter the first day of the delivery month for the March 1994 futures contract	3.011994	[SETT]	SETT=03.01.1994 MON
7) Enter the adjusted maturity date	9.012009	[MAT]	MAT=09.30.2009 TUE

8) Enter the coupon	11.75	[CPN%]	CPN%=11.7500
9) Change menus		[MORE]	
10) Enter 8% YTM	8	[YLD%]	YLD%=8.0000
11) Solve for the price		[PRICE]	PRICE=132.9784
12) Divide by 100	100	[÷]	1.3298

The CBOT actually uses a formula which duplicates the bond price calculation of the HP19B. The formula follows:

$$CF = \frac{\frac{C}{2} + \frac{C}{Y} \times \left(1 - \frac{1}{\left(1+\frac{Y}{2}\right)^{2\times N}}\right) + \frac{1}{\left(1+\frac{Y}{2}\right)^{2\times N}}}{\left(1+\frac{Y}{2}\right)^{\frac{X}{6}}} - \frac{C}{2} \times \frac{6-X}{6}$$

CF = Conversion Factor
C = Bond coupon rate in decimal form
Y = Nominal futures coupon of 8% in decimal form
N = Complete years to call or maturity, such that 2×N = the number of complete semi-annual periods to maturity.
X = The number of months in excess of the whole N, rounded down to complete quarters. For example, if the maturity is 27 years, 8 months, then N = 27 and X = 6.

If X calculated in this way equals 9, then 2×N should be set to 2×N+1 and X should be set to 3. For example if the maturity is 27 years, 11 months, then 2×N = 2×N+1 = 55 and X = 3.

LIFFE *Bund* Futures

LIFFE (and DTB) also uses a convention for calculating the conversion factor which alters the actual maturity of the bond by bringing it forward to the previous even 10th of the month. For example, the actual maturity of the 7 1/8% *Treuhand* above is 29 January 2003. For purposes of calculating the conversion factor, LIFFE sets the bond's maturity at 10 January 2003. Then a price is calculated which will yield the nominal coupon of 6%.

Unfortunately the HP12C cannot be used to calculate the price of a bond with annual coupons (without doing some programming), but the HP19B handles this very easily. First set the calculator to show 6 decimals, as that is the accuracy of LIFFE's conversion factors.

	Value	*Key*	*Display*
Choose display		[DISP]	TO SET #DECIMAL PLACES: PRESS {FIX} OR {ALL}.
Choose fix		[FIX]	TYPE #DIGITS (0-11); PRESS [INPUT]
Set accuracy to 6 digits	6	[INPUT]	
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the bond menu		[BOND]	A/A SEMIANNUAL
3) Set the type of bond to 30/360 annual		[TYPE] [360] [ANN]	30/360 ANNUAL
4) Exit back to the bond menu		[EXIT]	30/360 ANNUAL
5) Enter the delivery date for the December 1993 futures contract	12.101993	[SETT]	SETT=12.10.1993 FRI
6) Enter the adjusted maturity date	1.102003	[MAT]	MAT=01.10.2003 FRI
7) Enter the coupon	7.125	[CPN%]	CPN%=7.125000
8) Change menus		[MORE]	
9) Enter 6% YTM	6	[YLD%]	YLD%=6.000000
10) Solve for the price		[PRICE]	PRICE=107.689678
11) Divide by 100	100	[÷]	1.076897

This is the conversion factor listed for this bond.

Using a Conversion Factor

When a bond is tendered to the exchange, the *invoice price* is calculated as the futures settlement price multiplied by the conversion factor, plus accrued interest. If the above *Treuhand* bond with a face value of DM250,000 were delivered to the exchange on 10 December 1993 at a futures price of 99.86, for example, the delivery proceeds to the seller would be DM268,847, before considering the accrued interest:

Example

$$\text{Futures Price} \times \text{Conversion Factor} = \text{Invoice Price}$$

$$99.86 \times 1.076897 = 107.538934$$

$$107.538934\% \times DM250{,}000 = DM268{,}847$$

Adding the accrued interest from the previous coupon date (actually the issue date) of 29 January 1993 through the futures delivery date of 10 December 1993, to this amount gives us the total amount of the delivery proceeds:

Using the HP19B we can calculate the accrued interest owing the seller:

	Value	*Key*	*Display*
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the bond menu		[BOND]	A/A SEMIANNUAL
3) Set the type of bond to		[TYPE]	
30/360 annual		[360]	
		[ANN]	30/360 ANNUAL
4) Exit back to the bond menu		[EXIT]	30/360 ANNUAL
5) Enter the delivery date for the December 1993 futures contract	12.101993	[SETT]	SETT=12.10.1993 FRI
6) Enter the actual maturity date	1.292003	[MAT]	MAT=01.29.2003 THU
7) Enter the coupon	7.125	[CPN%]	CPN%=7.125000
8) Change menus		[MORE]	

9) Solve for the accrued interest		[ACCRU]	ACCRU=6.155208
10) Divide by 100	100	[÷]	0.061552
11) Multiply by the face value	250000	[×]	15,388.020833

With accrued interest of DM15,388 the full delivery proceeds come to:

	Value	*Key*	*Display*
1) Multiply the current futures price times	99.86	[×]	99.860000×
:2) The conversion factor divided by	1.076897	÷	107.538934÷
3) 100 times	100	×	1.075389×
4) The face value plus	250000	+	268,847.336050+
5) Accrued interest	15388.02	=	284,235.356050

The total delivery proceeds to the seller are DM284,235.36.

Basis

Basis is the difference between the price of a bond in the cash market and the price of the same bond in the futures market.

Basis comes in two forms: *net basis* and *gross basis*. Net basis refers to the difference in the price of the same bond in both markets, taking into consideration accrued interest, financing charges (repo rates), and any coupons received. Gross basis ignores all these financing costs and simply compares the two prices.

Cash and Carry Arbitrage

In order to understand basis, we will analyze a transaction wherein we buy a bond in the cash market and sell it in the futures market. Buying a bond in the cash market and selling it in the futures market, hoping to lock in a risk-free gain, is known as *cash and carry arbitrage*.

Example

The December 1993 *Bund* futures contract on LIFFE has a price of 99.86. Analysis of the cash and carry arbitrage using the bond at the top of the list of deliverable *Bunds* follows:

December 1993 *Bund* Futures

Settlement Date:	22-Nov-93
Futures Price:	99.86
Delivery Date:	10-Dec-93
Days:	18
Cash Market:	
Issue:	Treuhand
Maturity:	29-Jan-2003
Coupon:	7 1/8
Market Price:	107.363
Conversion Factor:	1.076897
Face Value:	DM250,000

The cash market price of the bond is calculated as follows. This calculation cannot be performed on the HP12C calculator, as the bond pays an annual coupon and the HP12C bond program only works for semi-annual U.S Treasury bonds. It is performed on the HP19B in the same manner as shown above in calculating the accrued interest and total price the futures exchange will pay:

	Value	*Key*	*Display*
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the bond menu		[BOND]	A/A SEMIANNUAL
3) Set the type of bond to		[TYPE]	
30/360 annual		[360]	
		[ANN]	30/360 ANNUAL
4) Exit back to the bond menu		[EXIT]	30/360 ANNUAL
5) Enter the settlement date	11.221993	[SETT]	SETT=11.22.1993 MON
6) Enter the maturity date	1.292003	[MAT]	MAT=01.29.2003 THU
7) Enter the coupon	7.125	[CPN%]	CPN%=7.125000
8) Change menus		[MORE]	
9) Enter the price	107.363	[PRICE]	PRICE=107.363000

10) Add		[+]	
11) Accrued interest		[ACCRU]	107.363000+5.798958
12) Add the price and accrued interest together		[=]	113.161958
13) Divide by		[÷]	113.161958÷
14) 100 times	100	[×]	1.131620×
15) Face value	250000	[=]	282,904.895832

The delivery proceeds are what the bond is worth on the delivery date through taking a short position in the futures market. This is exactly the same calculation already performed above on page 59, to calculate the total proceeds available on delivery of this bond. The delivery proceeds calculated above came to DM284,235.36.

Is there profit from this arbitrage? It depends on the financing cost. The break-even financing cost is the interest rate which makes the money to be repaid on the delivery date equal to the proceeds from the clearing house upon tendering the bonds.

This can be seen on a time line as follows:

Receive DM284,235

What is the break-even interest rate?

18 days

Pay DM282,905

The break-even interest rate is calculated as follows:

	Value	*Key*	*Display*
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the time value of money menu		[TVM]	1 PMTS/YR: END MODE
3) Enter the number of periods	1	[N]	N=1.0000
4) Enter the present value as a negative number	282905	[+/–] [PV]	PV=–282,905.0000
5) Enter the payments	0	[PMT]	PMT=0.0000

6) Enter the future value	284235	[FV]	FV=284,235.0000
7) Calculate the interest rate		[I%YR]	I%YR=0.4701
8) Times		[×]	0.4701×
9) 360 divided by	360	[÷]	169.2441÷
10) The actual days	18	[=]	9.4024

This is the break-even financing rate: 9.40%.

If the financing rate is lower than the break-even rate, buying the bond in the cash market and selling it in the futures market is a profitable arbitrage. With the repo rate at a level of 6.50%, this arbitrage would actually be profitable. Normally this is not the case.

The impled repo rate is usually less than the cash repo rate. Why? Because the seller of the future has certain options when delivering the bond. The seller can deliver the bond anytime during the month. Also the seller can deliver after the market closes. He can take advantage of economic news after the futures markets have closed, although this is less of a benefit to the seller now that the CBOT has night sessions. Also the seller has some timing options between actually notifying the exchange and delivering the bonds. These options are normally reflected in a lower futures price for the seller and hence a lower repo rate.

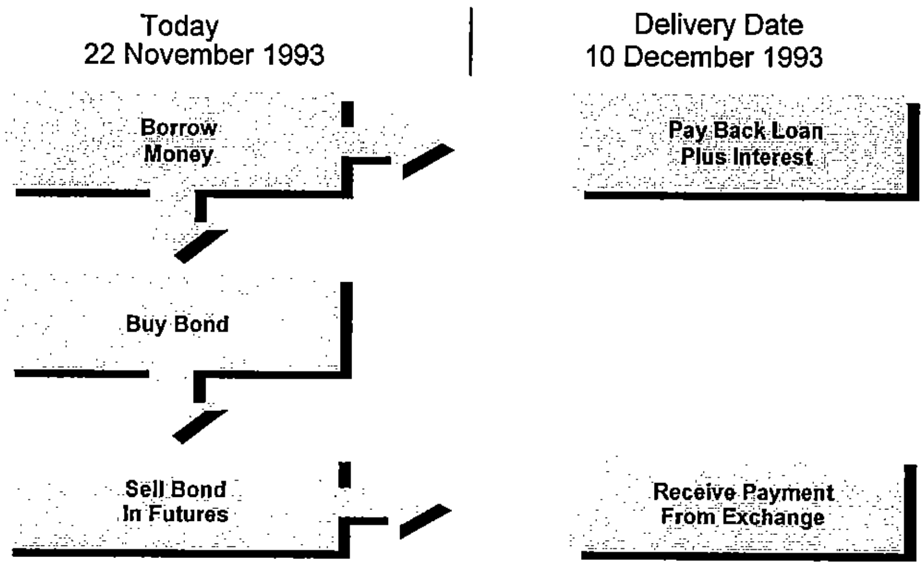
Net Basis

Net basis, also called *value basis*, is the difference in the two prices calculated above, expressed in the form of price points.

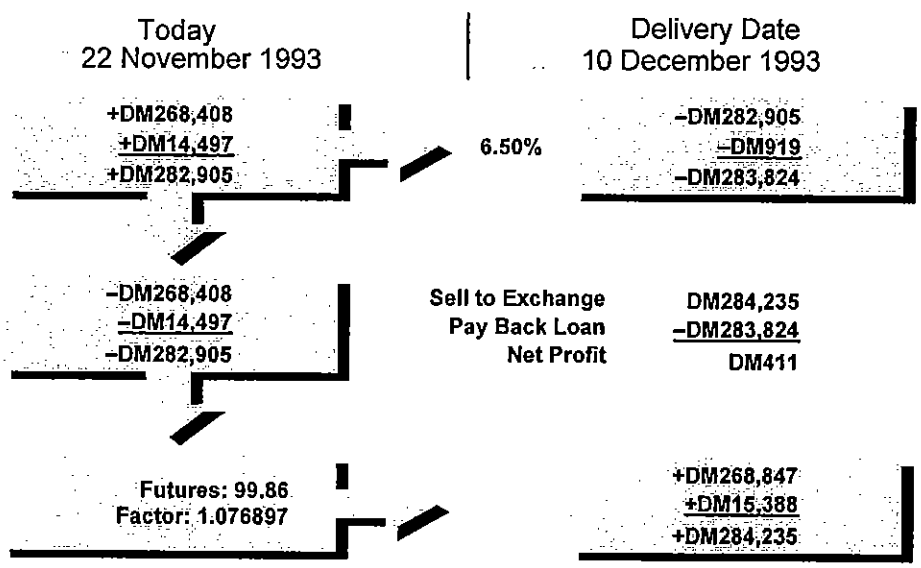
Net basis shows the profit or loss which would result from the cash and carry arbitrage financed at the market repo rate.

Comparing the financed price of buying the bond today and paying interest on the loan at the repo rate, to the total proceeds on delivery against a short position in the futures, calculates the net basis.

Here is a picture of the cash and carry arbitrage:



Putting amounts to the steps above shows the possible arbitrage:



In this case, profit amounts to DM411, which at DM25 per basis point of price (the tick value) represents net basis of 16.44 *basis points*. These basis points are expressed in terms of *price*, and should not be confused with basis points of interest rates.

+Futures Price	+DM268,847
+Accrued Interest	+DM15,388
−Cash Price	−DM268,408
−Accrued Interest	−DM14,497
−Repo Interest	−DM919
Net Basis	= DM411

$$\text{Net Basis} = \frac{411}{25} = 16.44 \text{ basis points of price}$$

Comparing the gross price in the cash market to the gross price in the futures market gives us the *gross basis*:

+Futures Price	+DM268,847
−Cash Price	−DM268,408
Gross Basis	= DM439

$$\text{Gross Basis} = \frac{439}{25} = 17.56 \text{ basis points of price}$$

Cheapest to Deliver

We can now define the cheapest to deliver bond directly: it is that bond with the highest break-even financing cost, or implied repo. This is often also the bond with the highest net basis, meaning the bond with the biggest positive difference between the futures price and the cash market price. We are using positive basis to mean that the price in the futures market is **higher** than the price in the cash market.

Using this logic, we can now compare the deliverable bonds and see the implied repo rate as the deciding factor for the cheapest to deliver:

Bond	Coupon	Maturity	Price	Conversion Factor	Net Basis	Implied Repo	Gross Basis
THA	7 1/8	29/1/2003	107.363	1.076897	16.4	9.41%	17.6
THA	6 7/8	11/6/2003	105.894	1.061493	9.6	8.27%	10.7
THA	7 3/8	2/12/2002	109.050	1.092700	6.9	7.68%	6.7
THA	7 3/4	1/10/2002	111.613	1.116075	-14.1	4.01%	-16.2

THA	6 1/2	23/4/2003	103.425	1.034535	-14.0	3.89%	-11.6
THA	6 5/8	9/7/2003	104.363	1.043798	-14.5	3.78%	-12.9
DBR	7 1/8	20/12/2002	107.956	1.076519	-47.1	-1.72%	-45.5
THA	6	12/11/2003	100.238	0.999868	-41.7	-1.82%	-39.1
DBR	7 1/4	21/10/2002	108.800	1.083526	-59.2	-4.32%	-59.9
DBR	6 3/4	22/4/2003	105.750	1.051997	-71.7	-6.57%	-69.8
DBR	8	22/7/2002	113.706	1.130619	-78.1	-6.92%	-80.2
DBR	6 1/2	15/7/2003	104.188	1.035197	-83.4	-9.17%	-81.3
DBR	6	15/9/2003	101.152	0.999674	-135.7	-20.04%	-132.5

Summarizing, we can observe that the 7 1/8% *Treuhand* due 29 January 2003 is the cheapest to deliver into the December *Bund* futures on LIFFE and DTB because it has the highest implied repo rate of 9.41%, and because it has the most favorable net basis of 16.4 basis points.

- The break-even financing rate for the cash and carry arbitrage is 9.41%. Since the actual market repo rate is 6.50%, the cash and carry arbitrage would be profitable.
- Buying it in the cash market and selling it in the futures market at 99.86 would yield a profit equal to 0.164% of the face value.

Treasury Bond Futures Cheapest to Deliver

The same logic is true with Treasury bond futures. The list below shows some of the deliverable bonds into the March 1994 Treasury bond futures contract on the CBOT, ranked in order of the implied repo rate:

Bond	Coupon	Maturity	Price	C. Factor	Net Basis	Implied Repo	Gross Basis
Treasury	11 3/4	15/11/2009	156 19/32	1.3298	-15.8	2.56%	-92.1
Treasury	13 1/4	15/5/2009	171 13/32	1.4539	-18.9	2.48%	-107.0
Treasury	12 1/2	15/8/2009	164 3/32	1.3921	-21.5	2.33%	-101.6
Treasury	11 1/4	15/2/2015	156 13/32	1.3262	-30.8	1.79%	-99.4
Treasury	10 5/8	15/8/2015	149 16/32	1.2659	-37.4	1.35%	-101.4
Treasury	9 7/8	15/11/2015	140 25/32	1.1910	-39.1	1.09%	-99.5
Treasury	9 1/4	15/2/2016	133 13/32	1.1277	-43.2	0.75%	-97.6
Treasury	8 3/4	15/5/2017	127 28/32	1.0783	-51.1	0.07%	-103.4
Treasury	8 7/8	15/8/2017	129 14/32	1.0915	-52.9	0.05%	-104.5
Treasury	9 1/8	15/5/2018	132 29/32	1.1192	-58.4	-0.26%	-113.1

The 11 3/4% coupon due 15 November 2009 is the cheapest to deliver (CTD) because it has the highest break-even financing cost, or implied repo rate, of 2.56%. If the maximum financing cost of a cash purchase is at a rate of 2.56%, a cash and carry arbitrage exactly breaks even.

With the market repo rate at 3.40% through the futures delivery date of 31 March 1994, the cash and carry arbitrage would lose money. How much? 15.8/32 (i.e. 0.49375) of the face value of the trade. The net basis is how much gain or lose exists through a cash and carry arbitrage, expressed in 32nds of a percent of face value (like the price quote on the Treasury bond and the futures contract itself).

To calculate the implied repo and net basis, keep in mind that the prices are all quoted in 32nds.

Implied Repo

Relevant Rates and Futures Price on:	**16-Nov-93**
June Bund Futures Contract:	
Price:	115 19/32
Delivery Date:	31-Mar-94
Days:	135

Cash Market	
Issue:	Treasury
Maturity:	15-Nov-09
Coupon:	11 3/4
Market Price:	156 19/32
Conversion Factor:	1.3298
Face Value:	$100,000.00

First we must buy the bond in the cash market:

Cash Market Price:	156 19/32
Times Face Value:	$100,000.00
Buy the Bund today and pay:	($156,593.75)
Plus Accrued Interest:	($32.46)
TOTAL Price	($156,626.21)

To calculate the accrued interest using the HP12C, you can do the following, taking into consideration that the last coupon was paid yesterday:

	Value	*Key*	*Display*
1) Clear financial registers and set accuracy to 4 digits		[f][REG] [f][4]	0.0000
2) Enter the first day of the current coupon period	11.151993	[ENTER]	11.1520
3) Enter the settlement date and calculate the number of days	11.161993	[g][ΔDYS]	1.0000
4) Store for future use		[STORE][1]	1.0000
5) Enter the first day of the current coupon period	11.151993	[ENTER]	11.1520
6) Enter the last day of the current coupon period and calculate the number of days	5.151994	[g][ΔDYS]	181.000
7) Divide into 1		[1/*x*]	0.0055

8) Multiply by the number of days stored above		[RCL][1][×]	0.0055
9) Multiply by the coupon	.1175	[×]	0.0006
10) Divide by 2 for the semi-annual coupon	2	[÷]	0.0003
11) Multiply by the bond's face value	100000	[×]	32.4586

The accrued interest amount is $32.46, as stated above.

Next sell the bond to the exchange and calculate the proceeds on the delivery date:

Current Futures Price:	115 19/32
Expressed as a decimal:	115.59375
Times Conversion Factor:	153.7166
Times Face Value:	$153,716.57
Plus Accrued Interest:	$4,414.36
TOTAL Price	$158,130.93

The accrued interest of $4,414.36 is calculated as above, using a settlement date of 31 March 1994 instead of 16 November 1993.

Now calculate the implied repo rate for the 135-day period from 16 November 1993 to 31 March 1994:

	Value	*Key*	*Display*
3) Enter the number of periods	1	[n]	1.0000
4) Enter the present value as a negative number	156626.21	[CHS][PV]	–156,626.2100
5) Enter the payments	0	[PMT]	0.0000
6) Enter the future value	158130.93	[FV]	158,130.9300
7) Calculate the interest rate		[i]	0.9607
8) Multiply by 360	360	[×]	345.8548
9) Divide by the actual days	135	[÷]	2.5619

The implied repo rate for the 11 3/4% Treasury due 15 November 2009 is 2.56%.

Net Basis

To calculate net basis compare the all-in price of the bond in the cash market, financed at the market repo rate of 3.40%, to the all-in price of the bond in the futures market.

The all-in price of the bond in the cash market: $156,626.21.

Calculate the FV of this price at a rate of 3.40% for 135 days, and then calculate the basis expressed in price points of 1/32% by dividing it by the tick value of $31.25:

	Value	*Key*	*Display*
1) Enter the number of periods	1	[n]	1.0000
2) Enter the present value as a negative number	156626.21	[CHS][PV]	–156,626.2100
3) Enter the payments	0	[PMT]	0.0000
4) Input the interest rate	3.4	[ENTER]	3.4000
5) Multiply by the actual days	135	[×]	459.0000
6) Divide by 360 and enter	360	[÷][i]	1.2750
7) Calculate the future value		[FV]	158,623.1942
8) Change the sign		[CHS]	–158,623.1942
9) Subtract from the all-in futures proceeds to get the net basis in $	158,130.93	[+]	–492.2642
10) Divide by the tick value of $31.25 to get the number of ticks	31.25	[÷]	–15.75

The net basis is –15.75 ticks, which means the price in the cash market financed at the repo rate is 16 basis points higher than the price in the futures market.

+Futures Price		+$153,716.57
+Accrued Interest		+$4,414.36
–Cash Price		–$156,593.75
–Accrued Interest		–$32.46
–Repo Interest		–$1,996.98
Net Basis	=	– $492.26

$$\text{Net Basis} = \frac{-492.26}{31.25} = -15.75 \text{ ticks}$$

Gross Basis

Comparing the gross price in the cash market to the gross price in the futures market gives us the *gross basis*:

+Futures Price	+$153,716.57
−Cash Price	−$156,593.75
Gross Basis	= −$2,877.18

$$\text{Gross Basis} = \frac{-2{,}877.18}{31.25} = -92.07 \text{ ticks}$$

Summary

- The oldest and most liquid futures contract covering changes in the value of governments bonds is the U.S. Treasury Bond future.
- All bond future contracts have specific deliverable bonds and tick values equal to the smallest price change of the underlying bond.
- U.S. Treasury Bond Futures trade on the Chicago Board of Trade (CBOT) and the London International Financial Futures and Options Exchange (LIFFE).
- *Bund* futures trade on LIFFE and the Deutsche Termin Börse (DTB) exchanges.
- The cheapest to deliver bond (CTD) is the bond most likely to be delivered by the seller of a bond futures contract.
- The cheapest to deliver bond is the bond which the seller can purchase most cheaply in the cash market to deliver into the futures contract.
- The cheapest to deliver bond is, out of all the bonds which are currently deliverable into the futures contract, the one which has the greatest implied repo rate. This bond theoretically offers the investor the largest return if he were to buy it in the cash market today and sell it in the futures market in the future.
- In low interest rate environments, bonds with high coupons and short duration tend to be the cheapest to deliver bonds.
- In high interest rate environments, bonds with low coupons and long duration tend to be the cheapest to deliver bonds.
- Repo rates are the interest expense for financing a purchase of a bond.
- Cost of carry is the interest rate or repo rate which increases the price of the bond in the future.
- The conversion factor for a deliverable bond is the adjustment to the price with which the bond would yield the theoretical coupon for the futures contract (8% for Treasury futures and 6% for *Bund* futures).
- *Basis* or *Gross Basis* is the difference in price between a bond in the cash market and the price of the same bond in the futures market.
- *Net Basis* refers to the difference in price of the same bond in the cash market and futures market taking into consideration accrued interest, financing charges (repo rates) and coupons.

D. Hedging with Bond Futures

Hedge Ratio Calculations

In order to hedge bonds with bond futures, we have to know how many futures contracts to use to offset the risk in the underlying bonds. There are two basic approaches used by market practitioners, which are in fact related to each other. The first we will analyze compares the change in value of the underlying bond position for a 0.01% change in the fixed rate to a change in value in the futures contract for a 0.01% change in the rate. The ratio of change gives us a hedge ratio based on **the value of a basis point.**

The second approach is similar, but attempts to measure the relative change in the underlying position and the hedge by means of **modified duration**. Since modified duration is an index of price sensitivity to a change of rate, the results should be similar under the two methods.

We will use a simple portfolio of a single *Bund* to test the first method, and a small portfolio of Treasuries to test the second.

Value of a Basis Point

The portfolio we will hedge consists of the following bond:

Bond	Coupon	Maturity	Price	Yield	Face Value
Bund	6	9/15/2003	101.152	5.8390%	DM250,000,000

Since we own this bond, we will have to *sell futures* to hedge it. We are using the futures market to sell the bond *synthetically*.

Underlying Bond

To hedge this portfolio, we have to measure how much its value changes if the applicable yield moves by one basis point up or down. With a simple portfolio like this all we have to do is recalculate the price. In order to establish a good reference, let us load this bond into the calculator and calculate its yield. We also need to know the bond's actual PV, which is the sum of the market price and the accrued interest, the so-called *dirty price*. For hedging purposes, it is the dirty price which we are protecting.

	Value	*Key*	*Display*
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the bond menu		[BOND]	A/A SEMIANNUAL

3) Set the type of bond to 30/360 annual		[TYPE]	
		[360]	
		[ANN]	30/360 ANNUAL
4) Exit back to the bond menu		[EXIT]	30/360 ANNUAL
5) Enter the settlement date	11.221993	[SETT]	SETT=11.22.1993 MON
6) Enter the maturity date	9.152003	[MAT]	MAT=09.15.2003 MON
7) Enter the coupon	6	[CPN%]	CPN%=6.000000
8) Change menus		[MORE]	
9) Enter the price	101.152	[PRICE]	PRICE=101.152000
10) Solve for YTM		[YLD%]	YLD%=5.838977
11) Solve for the accrued interest		[ACCRU]	ACCRU=1.116667
12) Recall the market price		[RCL]	PRICE=101.152000
		[PRICE]	
13) Add it to the accrued interest		[+]	102.268667

This is the initial dirty price of the bond which we are going to protect.

Without clearing the calculator, we will calculate the new dirty price under both a 1 basis point rise and fall of the current market yield.

14) Recall the YTM		[RCL]	
		[YLD%]	YLD%=5.838977
15) Add 1 basis point to it	.01	[+]	5.848977
16) Enter as the new YTM		[YLD%]	YLD%=5.848977
17) Solve for the new price		[PRICE]	PRICE=101.078306
18) Solve for the accrued interest		[ACCRU]	ACCRU=1.116667
19) Add to the market price		[+]	102.194972

This is the new PV under a 0.01% rise in the yield. Now we do it again, assuming the yield falls by 0.01%:

20) Recall the YTM		[RCL]	
		[YLD%]	YLD%=5.848977
21) Subtract 2 basis points from it	.02	[–]	5.828977
22) Enter as the new YTM		[YLD%]	YLD%=5.828977
23) Solve for the new price		[PRICE]	PRICE=101.225763
24) Solve for the accrued interest		[ACCRU]	ACCRU=1.116667
25) Add to the market price		[+]	102.342430

We can now make a table of the results:

Yield	Price	Change in Price	Average
5.848977%	102.194972	– 0.073695	
5.838977%	102.268667		0.073729
5.828977%	102.342430	+ 0.073763	

What the table tells us is that the price of the bond changes by 0.073729 each time the market yield changes by 0.01%. For our holdings of DM250,000,000, this means a change in value of:

$$\Delta PV = 0.073729\% \times DM250,000,000$$

$$\Delta PV = DM184,322.1525$$

The above equation is read, "*Delta* PV equals ..." and means "the change in the PV..."

This is the value of one basis point in the underlying bond position, DM184,322.15.

Futures Contract

The value of the futures contract will change based on two rate changes: the yield of the cheapest to deliver bond ("the CTD") and the repo rate. The repo rate is the primary source of basis in the CTD — assuming that the implied repo of the CTD stays relatively near the market repo, or that the net basis remains fairly small — and is notoriously difficult to hedge. Using bond futures it is not possible to hedge the basis — hence the origin of the term *basis risk* — but we can hedge changes in the yield of the CTD.

The CTD is itself another source of risk: can we be sure that the spread between the yield of the CTD and the yield of the bond(s) we wish to hedge will remain constant? If it does not, the changing spread introduces another source of risk into the hedge.

If we assume that the basis will remain constant and that changes in the market yield of the CTD will be mirrored basis point for basis point by changes in the yield of the bond(s) we wish to hedge, we can calculate a hedge ratio in the following manner.

First, we have to calculate how the changing yield of the CTD will affect its market value. This is essentially the same comparison we made above for the bond we own. Then we calculate a new futures price — assuming no change in the implied repo rate for the CTD. This gives us the value of a 0.01% change in the yield of the CTD on a single futures contract.

Bond	Coupon	Maturity	Price	Yield	Modified Duration	Face Value
Treuhand	7 1/8	1/29/2003	107.363	6.0521%	6.3839	DM250,000

	Value	*Key*	*Display*
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the bond menu		[BOND]	A/A SEMIANNUAL
3) Set the type of bond to 30/360		[TYPE]	
annual		[360]	
		[ANN]	30/360 ANNUAL
4) Exit back to the bond menu		[EXIT]	30/360 ANNUAL
5) Enter the settlement date	11.221993	[SETT]	SETT=11.22.1993 MON
6) Enter the maturity date	1.292003	[MAT]	MAT=01.10.2003 WED
7) Enter the coupon	7.125	[CPN%]	CPN%=7.125000
8) Change menus		[MORE]	
9) Enter the price	107.363	[PRICE]	PRICE=107.363000
10) Solve for YTM		[YLD%]	YLD%=6.052064
11) Solve for the accrued interest		[ACCRU]	ACCRU=5.798958
12) Recall the market price		[RCL]	PRICE=107.363000
		[PRICE]	
13) Add it to the accrued interest		[+]	113.161958

This is the initial dirty price of the cheapest to deliver bond.

Without clearing the calculator, we will calculate the new dirty price under both a 1 basis point rise and fall of the current market yield.

14) Recall the YTM		[RCL]	
		[YLD%]	YLD%=6.052064
15) Add 1 basis point to it	.01	[+]	6.062064
16) Enter as the new YTM		[YLD%]	YLD%=6.062064
17) Solve for the new price		[PRICE]	PRICE=107.290790
18) Solve for the accrued interest		[ACCRU]	ACCRU=5.798958
19) Add to the market price		[+]	113.089748

This is the new PV under a 0.01% rise in the yield. Now we do it again, assuming the yield falls by 0.01%:

20) Recall the YTM		[RCL]	
		[YLD%]	YLD%=6.062064
21) Subtract 2 basis points from it	.02	[–]	6.042064
22) Enter as the new YTM		[YLD%]	YLD%=6.042064
23) Solve for the new price		[PRICE]	PRICE=107.435273
24) Solve for the accrued interest		[ACCRU]	ACCRU=5.798958
25) Add to the market price		[+]	113.234232

We can now make a table of the results:

Yield	Price	Change in Price	Average
6.062064%	113.089748	– 0.072210	
6.052064%	113.161958		0.072242
6.042064%	113.234232	+ 0.072274	

We will use the average price change of 0.072242 in the CTD for a 0.01% change in its yield. The future value of this price change at the implied repo rate of 9.41% (calculated earlier) for 18 days (the period through delivery), adjusted by the conversion factor, gives us the value of the 0.01% on the futures price. The effect of using the FV at the implied repo rate is very small (less than 1/3 of a basis point), so we will ignore it and make the equation simpler.

This relationship can be reduced to a fairly straightforward formula, if we assume that the face value of the CTD is equal to the face value of a single futures contract:

$$\frac{\Delta PV_F}{100} \times FV_F \times CF = \frac{\Delta PV_{CTD}}{100} \times FV_{CTD}$$

$$\Delta PV_F = \frac{\Delta PV_{CTD}}{CF}$$

$$\Delta PV_F = \frac{0.072242}{1.076897}$$

$$\Delta PV_F = 0.067083$$

Where:

ΔPV_F	=	Change in price of 1 futures contract
FV_F	=	Face value of 1 futures contract
CF	=	Conversion factor for the CTD
ΔPV_{CTD}	=	Change in price of the CTD
FV_{CTD}	=	Face value of the CTD

The formula tells us that the price change we can expect in the futures contract for a 1 basis point change in the yield of the CTD is 0.067083, or 6.7083 ticks. Since each tick is worth DM25, and we have 6.7083 of them, the value of a 0.01% change in the yield of the CTD is DM167.71 per futures contract.

$$\Delta PV_F = 6.7083 \times DM25 = DM167.7075 \text{ per contract}$$

Hedge Ratio Calculation

Since we know the value of a 0.01% change in yields for both the underlying bond and for the futures contract, we can use the two values to calculate our hedge ratio:

$$\frac{DM184,322.15}{DM167.7075} = 1,099.07$$

This ratio tells us that we need to use 1,099 futures contracts to offset the change in PV on our portfolio from a 0.01% change in yields. This makes sense intuitively, as our cash position is roughly 1,000 times bigger than the face value of a single futures contract.

We need to use slightly more than 1,000 contracts because the PV of the CTD (and hence the futures) is less sensitive to changes in rates than is the PV of the newly issued (and longer duration) 6% *Bund.*

Modified Duration-Based Hedge Ratio

The above relationships can be stated a good deal more simply if we use modified duration to give us the value of the 0.01% change in yield. Since that is what modified duration is, i.e. an index of price sensitivity to changes in yields, this is a very reasonable approach. It is also easier!

We can summarize the above calculations into a single, fairly straightforward hedge ratio. The derivation of this ratio is beyond the scope of this self-instructional guide, but we can use it without having to know how to derive it. The logic is very similar to that followed above, as we are using the relative price sensitivity of the CTD (as the source of changes in the futures price) and the bonds we own to determine how many futures contracts to sell.

The basic relationship is as follows:

$$PV_U \times MD_U \times \Delta i_U = -\#C \times PV_{CTD} \times MD_{CTD} \times \frac{FV_F}{CF} \times \Delta i_{CTD}$$

Where:

PV_U = Market value of the underlying bond or portfolio of bonds
MD_U = Modified duration of the underlying bond or portfolio of bonds
Δi_U = Change in yield of the underlying bond or portfolio of bonds
$\#C$ = Number of futures contracts
PV_{CTD} = Market value of the CTD, expressed as a decimal
MD_{CTD} = Modified duration of the CTD
FV_F = Face value of the futures contract
CF = Conversion factor for the CTD
Δi_{CTD} = Change in yield of the CTD

The above formula can be read, "The market value of the underlying times the modified duration of the underlying times the expected change in yield of the underlying is to be offset by a change in the futures position equal to the number of futures contracts times the market value of the cheapest to deliver times the modified duration of the CTD times

the face value of one futures contract divided by the conversion factor of the CTD times the expected change in yield of the CTD."

If we wish to know how many futures contracts to buy or sell, we must solve the above equation for #C:

$$\#C = -\frac{PV_U}{PV_{CTD}} \times \frac{MD_U}{MD_{CTD}} \times \frac{CF}{FV_F} \times \frac{\Delta i_U}{\Delta i_{CTD}}$$

Note that we are hedging the market value of the underlying position, i.e. its dirty price times the face value of our holdings. We will also assume that the yield spread between the CTD *Treuhand* and the *Bund* we own remains constant, so that the ratio of changes in the interest rates is 1 to 1. We might make any assumption we wish about this, actually, but the level of the spread is hard to predict.

We can use the above equation to solve for the number of contracts we need to sell in order to hedge our position in the new 6% *Bund* by plugging in the numbers:

$$\#C = -\frac{250{,}000{,}000 \times 102.268667\%}{113.161958\%} \times \frac{7.2093}{6.3839} \times \frac{1.076897}{250{,}000} \times \frac{0.01\%}{0.01\%}$$

$$\#C = -1{,}099.06$$

Again, we need to sell 1,099 December *Bund* futures contracts to protect our holdings of DM250,000,000 of the 6% *Bund* due 15 September 2003 from rising rates.

This is the same number of contracts we calculated above using the value of a basis point method. It should be, as modified duration is an index of price change given a change in rates.

We might also summarize the assumptions we have made, or the risks we are taking in hedging this position:

1. We assume no change in the yield spread between the CTD 7 1/8% *Treuhand* and the 6% *Bund* we own, currently 0.2131%.

2. We assume no change in the net basis or repo rate for the CTD, currently 0.164 and 9.41% respectively.

3. We also assume that the CTD bond does not change.

If all these assumptions are good, our hedge will work pretty well.

Adjusting the Duration of the Underlying Position

In the example above, we used the futures market to offset all of the duration of the underlying position.

In a similar fashion, we can use the futures to adjust the duration of our portfolio to a level we wish to target. To do so, we need only consider the *weighted average duration* of the portfolio we wish to achieve.

An important note is that futures cannot be used to extend the duration of a portfolio out past the duration of the CTD. By selling futures against a portfolio of bonds we own, however, we can use them to decrease the duration of the portfolio.

However much of our existing position we offset using futures, we reduce the duration to 0 for that amount of the position.

Above, for example, we brought the duration of our net position, owning the 6% *Bund* and selling 1,099 December 1993 *Bund* futures contracts, to 0.

We can express this relationship in a formula as follows:

$$\text{Hedge\%} \times MD_{Hedge} + (1 - \text{Hedge\%}) \times MD_U = MD_{Target}$$

Whatever percent of the underlying position we hedge, we reduce its duration, the MD_{Hedge} above, to 0. If we select a target duration, we can solve for the Hedge% we need to achieve it. This is a function of the duration of the underlying position. We can therefore simplify the above equation as follows:

$$\text{Hedge\%} = \frac{MD_U - MD_{Target}}{MD_U}$$

This equation shows us that if we wish to achieve a target duration of 0, we have to hedge 100% of our underlying position:

$$\text{Hedge\%} = \frac{7.2093 - 0}{7.2093} = 100\%$$

If we wished to decrease the duration of the underlying position to 3, for example, we would have to hedge 58.39% of the position:

$$\text{Hedge\%} = \frac{7.2093 - 3}{7.2093} = 58.3871\%$$

We know from above that to hedge 100% of our underlying position, we would have to sell 1,099 contracts. Therefore to hedge 58.39% of our position, we have to sell 641 contracts:

$$58.3871\% \times 1{,}099 = 641.67$$

It should be noted that we are not actually changing the duration of the portfolio in terms of the tenor of the rates to which we have exposure. Rather, what we are doing is making smaller the impact of a change in the same rate on our portfolio. It is best to consider this decrease in duration not in terms of time, or years, but rather in terms of sensitivity. If we begin with an underlying position that is 100% sensitive to a change in the market yields affecting it, we can reduce the index of sensitivity to 0% by fully offsetting the underlying position through the sale of futures contracts.

In the example above, we have reduced the sensitivity of our position to changing rates from 100% to 41.61% (100% – 58.39%) by reducing the duration to 3.

Summary

- A hedge ratio determines how many futures contracts to use to offset the risk of an underlying bond.
- The change in the value of a bond for a 1 basis point change in rates is known as the value of a basis point.
- Either modified duration analysis or value of a basis point analysis can be used to determine the hedge ratio. The results should be similar.
- The dirty price of a bond is the market value plus any accrued interest. Hedging should control risk for the dirty price of a bond.
- The value of a futures price will change based on two rates - the yield of the cheapest to deliver bond and the repo rate.
- Changes due to the repo rate are difficult to hedge. However the changes in the yield of the cheapest to deliver bond can be hedged.
- If the spread between the yield on the cheapest to deliver bond and the bond being hedged does not remain constant, this will add another source of risk to the hedge.
- If the cheapest to deliver bond changes the hedge will need to be adjusted.
- Futures can be used to decrease the duration of a portfolio but futures cannot be used to increase the duration of a portfolio out past the duration of the cheapest to deliver.

Exercises

1. Please calculate the break-even financing cost for buying the 6% *Bund* due 15 September 2003 and selling it into the December 1993 *Bund* futures contract.

2. Please calculate the implied repo rate, net basis and gross basis for the same bond.

3. Please calculate how many March 1994 Treasury bond futures contracts you need to sell to hedge all price change in the following portfolio of Treasury bonds:

Bond	Coupon	Maturity	Price	Yield	Modified Duration	Face Value	Market Value
Treasury	6 1/4	15-Aug-2023	101 5/32	6.1638%	13.3184	$75,000,000	$77,051,800.27
Treasury	8 1/2	15-Feb-2020	125 21/32	6.4569%	11.7578	$55,000,000	$70,292,391.30
Treasury	12 1/2	15-Aug-2009	164 3/32	6.1050%	8.5638	$25,000,000	$41,813,179.35
Portfolio					11.6875	$155,000,000	$189,157,370.92
CTD	11 3/4	15-Nov-2009	156 19/32	6.1436%	8.8916		

4. How many contracts must you sell if you wish to decrease the duration of the portfolio owned to 5 years?

5. Please calculate the conversion factor for the following bond deliverable into the March 1994 Treasury bond futures contract:

Cash Market	
Issue:	Treasury
Maturity:	15-May-2018
Settlement:	16-Nov-1993
Coupon:	9 1/8
Market Price:	132 29/32
Face Value:	$100,000.00

Futures Market	
March 1994 Treasury Bond Futures Contract Price:	115 19/32
Settlement	16-Nov-1993
Delivery Date:	31-Mar-1994
Days:	135

APPENDIX I. EXCHANGE DIRECTORY

This exhibit contains a summary of the leading interest rate futures exchanges. It includes information on the interest rate futures contracts traded as of December 1993.

AUSTRALIA

SYDNEY FUTURES EXCHANGE — SFE
(Sydney, Australia)

Futures	Size	Tick Size	Months
90-day Bank Bills	A$500,000	0.01% ≈ A$12.00 (variable)	Mar Jun Sep Dec
3-year T-bonds	A$100,000	0.01% = A$25	Mar Jun Sep Dec
10-year T-bonds	A$100,000	0.005% = A$25.00	Mar Jun Sep Dec

BELGIUM

Belgian Futures and Options Exchange — BELFOX
(Brussels, Belgium)

Futures	Size	Tick Size	Months
Belgian Gov. Bonds	BEF2,500,000	0.01 pt. = BEF250	Mar Jun Sep Dec
BIBOR 3-Month	BEF25,000,000	0.01% = BEF2,500	Mar Jun Sep Dec

BRAZIL

BOLSA BRASILEIRA DE FUTUROS
(Rio de Janeiro, Brazil)

Futures	Size	Tick Size	Months
BTN (T-bill)	BTN5,000	Cr$0.01	All Months

BOLSA DE MERCADORIAS & FUTUROS — BM&F
(São Paulo, Brazil)

Futures	Size	Tick Size	Months
1-Day Interbank Deposits	Cr$100,000,000	1 pt. = Cr$1,000	All Months
30-Day Interbank Deposits	Cr$100,000,000	1 pt. = Cr$1,000	All Months

CANADA

MONTREAL EXCHANGE — ME
(Montreal, Quebec, Canada)

Futures	Size	Tick Size	Months
1-Month Canadian BAs	C$3,000,000	0.01% = C$25	First 6 months
3-Month Canadian BAs	C$1,000,000	0.01% = C$25	Mar Jun Sep Dec
10-Year Gov. of Canada Bond	C$100,000	0.01 pt. = C$10	Mar Jun Sep Dec
Gov. of Canada Bond	C$25,000	0.01 pt. = C$2.50	Mar Jun Sep Dec: 3 months plus two

DENMARK

COPENHAGEN STOCK EXCHANGE AND GUARANTEE FUND FOR DANISH OPTIC AND FUTURES — FUTOP
(Copenhagen, Denmark)

Futures	Size	Tick Size	Months
Danish Gov. Bonds (series of contracts on specific issues)	DKr1,000,000	0.05 pt. = DKr500	Mar Jun Sep Dec
Mortgage Credit Bonds 9% 2022	DKr1,000,000	0.05 pt. = DKr500	Mar Jun Sep Dec

FRANCE

MARCHÉ À TERME INTERNATIONAL DE FRANCE — MATIF
(Paris, France)

Futures	Size	Tick Size	Months
Long-Term Notional Bond	FFr500,000	0.02% = FFr100	Mar Jun Sep Dec
3-month PIBOR	FFr5,000,000	0.01% = FFr125	Mar Jun Sep Dec
Long-Term Italian Bond	Lit100,000,000	1 pt. = Lit10,000	Mar Jun Sep Dec
ECU Bond	ECU100,000	0.02 pt. = ECU20	Mar Jun Sep Dec

GERMANY

DEUTSCHE TERMINBÖRSE — DTB
(Frankfurt, Germany)

Futures	Size	Tick Size	Months
Long-Term Gov Bond: *Bund*	DM250,000	0.01 = DM25.00	Mar Jun Sep Dec
Medium-Term Gov Bond: *Bobl*	DM250,000	0.01 = DM25.00	Mar Jun Sep Dec
3-Month FIBOR (soon)	DM1,000,000	0.01% = DM25	Mar Jun Sep Dec
Extra-Long-Term Gov Bond: Buxl (soon)	DM250,000	0.01 = DM25.00	Mar Jun Sep Dec

HONG KONG

HONG KONG FUTURES EXCHANGE LTD. — HKFE
(Hong Kong)

Futures	Size	Tick Size	Months
3-month HIBOR (inactive since 1991)	HK1,000,000	1 pt. = HK$25	Mar Jun Sep Dec

IRELAND

IRISH FUTURES & OPTIONS EXCHANGE — IFOX
(Dublin, Ireland)

Futures	Size	Tick Size	Months
Long Gilt	IR£50,000	IR£5	Mar Jun Sep Dec
Short Gilt	IR£100,000	IR£10	Mar Jun Sep Dec
3-month Interest Rate	IR£500,000	IR£12.50	Mar Jun Sep Dec

JAPAN

TOKYO INTERNATIONAL FINANCIAL FUTURES EXCHANGE — TIFFE
(Tokyo, Japan)

Futures	Size	Tick Size	Months
3-month Euroyen	¥1,000,000,000	0.01 pt. = ¥2,500	Mar Jun Sep Dec
3-month Eurodollar	$1,000,000	0.01 pt. = $25	Mar Jun Sep Dec
1-Year Euroyen	¥100,000,000	0.01 pt. = ¥10,000	Mar Jun Sep Dec

TOKYO STOCK EXCHANGE — TSE
(Tokyo, Japan)

Futures	Size	Tick Size	Months
10-yr. Japanese Gov. Bond	¥100,000,000	0.01 pt. = ¥10,000	Mar Jun Sep Dec
20-yr. Japanese Gov. Bond	¥100,000,000	0.01 pt. = ¥10,000	Mar Jun Sep Dec
U.S. T-bond	$100,000	1/32 pt. = US$31.25	Mar Jun Sep Dec

NETHERLANDS

EUROPEAN OPTIONS EXCHANGE — EOE-Optiebeurs
(Amsterdam,, Netherlands)

Futures	Size	Tick Size	Months
Dutch Gov. Bonds	DFl10,000	DFl0.01	Feb May Aug Nov
Notional Bond	DFl250,000	DFl0.01	Feb May Aug Nov

FINANCIELE TERMIJNMARKT AMSTERDAM N.V. — FTA
(Amsterdam, Netherlands)

Futures	Size	Tick Size	Months
Guilder bonds	DFl250,000	0.01 pt. = DFl25	Mar Jun Sep Dec

NEW ZEALAND

NEW ZEALAND FUTURES & OPTIONS EXCHANGE — NZFOE
(Auckland, New Zealand)

Futures	Size	Tick Size	Months
90-day Bank Accepted Bills	NZ$500,000	0.01% ≈ NZ$12 (variable)	Mar Jun Sep Dec
5-yr. Gov. Stock #2	NZ$100,000	0.01 = NZ$10	Mar Jun Sep Dec
10-yr. Gov. Stock	NZ$100,000	0.01 = NZ$10	Mar Jun Sep Dec

PHILIPPINES

MANILLA INTERNATIONAL FUTURES EXCHANGE — MIFE
(Makati, The Philippines)

Futures	Size	Tick Size	Months
Interest Rates	10,000 pesos	0.01%	Next 4 months

SINGAPORE

SINGAPORE INTERNATIONAL MONETARY EXCHANGE — SIMEX
(Singapore)

Futures	Size	Tick Size	Months
Eurodollar	$1,000,000	0.01 pt. = US$25	Mar Jun Sep Dec
Euromark	DM1,000,000	0.01 pt. = DM25	Mar Jun Sep Dec
Euroyen	¥100,000,000	0.01 pt. = ¥2,500	Mar Jun Sep Dec

SOUTH AFRICA

SOUTH AFRICAN FUTURES EXCHANGE — SAFEX
(Johannesburg, South Africa)

Futures	Size	Tick Size	Months
Short-Term Interest	1,000,000 R	0.01% = 25 R	Feb May Aug Nov
Long Bond	100,000 R	0.01 = 10 R	Feb May Aug Nov

SPAIN

MERCADO DE FUTUROS FINANCIEROS S.A. — MEFF
(Barcelona, Spain)

Futures	Size	Tick Size	Months
MIBOR	Ptas10,000,000	1 pt. = Ptas 250	Mar Jun Sep Dec
3-Year Notional Bond	Ptas 10,000,000	1 pt. = Ptas 250	Mar Jun Sep Dec
10-Year Notional Bonds	Ptas10,000,000	1 pt. = Ptas 1,000	Mar Jun Sep Dec

SWEDEN

STOCKHOLM OPTIONS MARKET — OM Stockholm
(Stockholm, Sweden)

Futures	Size	Tick Size	Months
OMr5 Notional Bonds	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
OMR7 Notional Bonds	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
Notional T-bills	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
OMr10 Notional Bonds	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
MBB5 Mortgage Bonds	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
CT2 Mortgage Bonds	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
CT5 Mortgage Bonds	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
Stibor	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
OMSwap	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
SBAB 5 Mortgage	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec
Interest Rate	SKr1,000,000	0.01 SEK	Mar Jun Sep Dec
OMr2	SKr1,000,000	0.01 pt.	Mar Jun Sep Dec

SWITZERLAND

SWISS OPTIONS AND FINANCIAL EXCHANGES — SOFFEX
(Dietikon, Switzerland)

Futures	Size	Tick Size	Months
3-Month Eurofranc	SFr1,000,000	0.01 pt. = SFr25	Mar Jun Sep Dec
5-year Swiss Franc Interest Rate	SFr100,000	0.01% = SFr10	Next 4 months of Mar Jun Sep Dec
Swiss Gov. Bonds	SFr100,000	0.01% = SFr10	Next 4 months of Mar Jun Sep Dec

UNITED KINGDOM

LONDON INTERNATIONAL FINANCIAL FUTURES AND OPTIONS EXCHANGE — L
(London, England)

Futures	Size	Tick Size	Months
3-month Eurodollars	$1,000,000	0.01% = $25	Mar Jun Sep Dec
3-Month Sterling Interest Rate	£500,000	0.01% = £12.50	Mar Jun Sep Dec
3-month Euromark	DM1,000,000	0.01% = DM25	Mar Jun Sep Dec
3-month Euro Swiss	SFr1,000,000	0.01% = SFr25	Mar Jun Sep Dec
3-month Euro Lira Interest Rate	Lit1,000,000,000	0.01% = Lit25,000	Mar Jun Sep Dec
3-month ECU Interest Rate	ECU1,000,000	0.01% = ECU25	Mar Jun Sep Dec
Long Gilt	£50,000	£1/32 = £15.625	Mar Jun Sep Dec
U.S. T-bonds	$100,000	1/32 pt. = US$31.25	Mar Jun Sep Dec

Japanese Gov. Bond	¥100,000,000	0.01 pt. = ¥10,000	Mar Jun Sep Dec
German Gov. Bond: *Bund*	DM250,000	0.01 pt. = DM25	Mar Jun Sep Dec
Medium-Term German Gov. Bonds: *Bobl*	DM250,000	0.01 pt. = DM25	Mar Jun Sep Dec
Italian Gov. Bonds	Lit200,000,000	0.01 pt. = Lit20,000	Mar Jun Sep Dec

UNITED STATES

CHICAGO BOARD OF TRADE — CBOT
(Chicago, Illinois)

Futures	Size	Tick Size	Months
U.S. Treasury Bonds	$100,000	1/32 pt. = $31.25	Mar Jun Sep Dec
10-yr. T-notes	$100,000	1/32 pt. = $31.25	Mar Jun Sep Dec
5-yr. T-notes	$100,000	1/64 pt. = $15.625	Mar Jun Sep Dec
2-yr. T-notes	$200,000	1/4 of 1/32 pt. = $15.625	Mar Jun Sep Dec
30-day Interest rate	$5,000,000	0.01% = $41.67	All Months
Municipal Bond Index	$1,000 × Bond Buyer Index	1/32 pt. = $31.25	Mar Jun Sep Dec
PROJECT A CONTRACTS			
Zero Coupon Bond	$100,000	1/32 pt. = $31.25	Mar Jun Sep Dec
Zero Coupon Note	$100,000	1/32 pt. = $31.25	Mar Jun Sep Dec

CHICAGO MERCANTILE EXCHANGE (International Monetary Market Division) — I
(Chicago, Illinois)

Futures	Size	Tick Size	Months
Treasury Bills	$1,000,000	1 pt. = $25	Mar Jun Sep Dec
Eurodollar Time Deposit	$1,000,000	1 pt. = $25	Mar Jun Sep Dec
1-month LIBOR	$3,000,000	1 pt. = $25	All Months

MIDAMERICA COMMODITY EXCHANGE — MidAm
(Chicago, Illinois)

Futures	Size	Tick Size	Months
U.S. T-bonds	$50,000	1/32 pt. = $15.62	Mar Jun Sep Dec
U.S. T-bills	$500,000	1 pt. = $12.50	Mar Jun Sep Dec
U.S. T-notes	$50,000	1/32 pt. = $15.62	Mar Jun Sep Dec
Eurodollar	$500,000	1 pt. = $12.50	Mar Jun Sep Dec

FINANCIAL INSTRUMENT EXCHANGE — FINEX
(division of the New York Cotton Exchange — New York, New York)

Futures	Size	Tick Size	Months
2-year T Auction Notes	$100 × basis points of yield	0.005 pt. = $50	All months
5-year T Auction Notes	$100 × basis points of yield	0.005 pt. = $50	All months

Bond Futures

1. Please calculate the break-even financing cost for buying the 6% *Bund* due 15 September 2003 and selling it into the December 1993 *Bund* futures contract.

Relevant Rates and Futures Prices on:	**22-Nov-93**
Futures Price:	99.86
Delivery Date:	10-Dec-93
Days:	18
Cash Market:	
Issue:	Bund
Maturity:	15-Sep-2003
Coupon:	6
Market Price:	101.152
Conversion Factor:	0.999674
Face Value:	DM250,000

First we must buy the bond in the cash market:

Cash Market Price:	101.152
Times Face Value:	DM250,000
Buy the Bund today and pay:	(DM252,880)
Plus Accrued Interest:	(DM2,792)
TOTAL Price	(DM255,672)

Next we sell the bonds to the exchange and calculate the proceeds we will receive on the delivery date. First we have to calculate the accrued interest:

	Value	*Key*	*Display*
1) Choose the financial menu		[FIN]	SELECT A MENU
2) Choose the bond menu		[BOND]	A/A SEMIANNUAL
3) Set the type of bond to		[TYPE]	
30/360 annual		[360]	
		[ANN]	30/360 ANNUAL

For information contact:

The Globecon Group, Ltd.
71 Murray Street, 10th fl.
New York, NY 10007
(212) 608-1160 phone
(212) 227-0443 fax

4) Exit back to the bond menu		[EXIT]	30/360 ANNUAL
5) Enter the delivery date for the December 1993 futures contract	12.101993	[SETT]	SETT=12.10.1993 FRI
6) Enter the actual maturity date	9.152003	[MAT]	MAT=09/15/2003 MON
7) Enter the coupon	6	[CPN%]	CPN%=6.000000
8) Change menus		[MORE]	
9) Solve for the accrued interest		[ACCRU]	ACCRU=1.416667
10) Divide by		[÷]	1.416667÷
11) 100 times	100	[×]	0.014167×
12) The face value	250000	[=]	3,541.666667

With accrued interest of DM3,542 the full delivery proceeds come to:

	Value	*Key*	*Display*
1) Multiply the current futures price times	99.86	[×]	99.860000×
:2) The conversion factor divided by	0.999674	÷	99.827446÷
3) 100 times	100	×	0.998274×
4) The face value plus	250000	+	249,568.614100+
5) Accrued interest	3541.666667	=	253,110.280767

The total delivery proceeds to the seller are DM253,110.28.

Did we make money? It depends on the financing cost. We can calculate the break-even financing cost as the interest rate which makes the money we must repay on the

delivery date equal to the proceeds we will receive from the futures exchange for selling the bonds.

This can be seen on a time line as follows:

Receive DM253,110

What interest rate must we borrow at to break even?

18 days

Pay DM255,672

We can calculate the rate using the calculator as follows:

		Value	*Key*	*Display*
1)	Choose the financial menu		[FIN]	SELECT A MENU
2)	Choose the time value of money menu		[TVM]	1 PMTS/YR: END MODE
3)	Enter the number of periods	1	[N]	N=1.0000
4)	Enter the present value as a negative number	255672	[+/–] [PV]	PV=–255,672.0000
5)	Enter the payments	0	[PMT]	PMT=0.0000
6)	Enter the future value	253110	[FV]	FV=53,110.0000
7)	Calculate the interest rate		[I%YR]	I%YR=–1.0021
8)	Multiply by 360	360	[×]	–360.7435
9)	Divide by the actual days	18	[÷]	–20.0413

This is the break-even financing rate: –20.04%.

If we can borrow money at any rate lower than the break-even rate, we can make money by buying the bond in the cash market and selling it in the futures market. With the repo rate at a level of 6.50%, this arbitrage would clearly not be profitable.

In order to make money by arbitraging this bond, we would have to be able to borrow money at a negative rate of interest, i.e. the lender would have to pay us to induce us to borrow the money.

2. Please calculate the implied repo rate, net basis and gross basis for the same bond.

Implied Repo

First we must buy the bond in the cash market:

Cash Market Price:	132 29/32
Times Face Value:	$100,000.00
Buy the Bund today and pay:	($132,906.25)
Plus Accrued Interest:	($25.21)
TOTAL Price	($132,931.46)

To calculate the accrued interest using the HP12C, you can do the following:

	Value	*Key*	*Display*
1) Clear financial registers and set accuracy to 4 digits		[f][REG] [f][4]	0.0000
2) Enter the first day of the current coupon period	11.151993	[ENTER]	11.1520
3) Enter the settlement date and calculate the number of days	11.161993	[g][ΔDYS]	1.0000
4) Store for future use		[STORE][1]	1.0000
5) Enter the first day of the current coupon period	11.151993	[ENTER]	11.1520
6) Enter the last day of the current coupon period and calculate the number of days	5.151994	[g][ΔDYS]	181.000
7) Divide into 1		[1/x]	0.0055
8) Multiply by the number of days stored above		[RCL][1][×]	0.0055
9) Multiply by the coupon	.09125	[×]	0.0005

10) Divide by 2 for the semi-annual coupon	2	[÷]	0.0003
11) Multiply by the bond's face value	100000	[×]	25.2072

The accrued interest amount is $25.21, as stated above.

Next we must sell the bond to the exchange and calculate the proceeds we will receive on the delivery date:

Current Futures Price:	115 19/32
Times Conversion Factor:	129.3725
Times Face Value:	$129,372.53
Plus Accrued Interest:	$3,428.18
TOTAL Price	$132,800.70

The accrued interest of $3,428.18 is calculated as above, using a settlement date of 31 March 1994 instead of 16 November 1993.

Now we can calculate the implied repo rate for the 135-day period from 16 November 1993 to 31 March 1994:

	Value	*Key*	*Display*
3) Enter the number of periods	1	[n]	1.0000
4) Enter the present value as a negative number	132931.46	[CHS][PV]	–132,931.4600
5) Enter the payments	0	[PMT]	0.0000
6) Enter the future value	132800.7	[FV]	132,800.7000
7) Calculate the interest rate		[i]	–0.0984
8) Multiply by 360	360	[×]	–35.4119
9) Divide by the actual days	135	[÷]	–0.2623

The implied repo rate for the 9 1/8% Treasury due 15 May 2018 is –0.26%.

Net Basis

To calculate net basis we must compare the all-in price of the bond in the cash market, financed at the market repo rate of 3.40%, to the all-in price of the bond in the futures market.

We already know the all-in price of the bond in the cash market: $132,931.46.

We can calculate the FV of this price at a rate of 3.40% for 135 days, and then calculate the basis expressed in price points of 1/32% by dividing it by the tick value of $31.25:

	Value	*Key*	*Display*
1) Enter the number of periods	1	[n]	1.0000
2) Enter the present value as a negative number	132931.46	[CHS][PV]	–132,931.4600
3) Enter the payments	0	[PMT]	0.0000
4) Input the interest rate	3.4	[ENTER]	3.4000
5) Multiply by the actual days	135	[×]	459.0000
6) Divide by 360 and enter	360	[÷][i]	1.2750
7) Calculate the future value		[FV]	134,626.3361
8) Change the sign		[CHS]	–158,623.1942
9) Subtract from the all-in futures proceeds to get the net basis in $	132800.7	[+]	–1,825.6361
10) Divide by the tick value of $31.25 to get the number of ticks	31.25	[÷]	–58.4204

The net basis is –58.42 ticks, which means the price in the cash market financed at the repo rate is 58 basis points higher than the price in the futures market.

+Futures Price	+$129,372.53
+Accrued Interest	+$3,428.18
−Cash Price	−$132,906.25
−Accrued Interest	−$25.21
−Repo Interest	−$1,694.88
Net Basis	= −$1,825.63

$$\text{Net Basis} = \frac{-1825.63}{31.25} = -58.42 \text{ ticks}$$

Gross Basis

Comparing the gross price in the cash market to the gross price in the futures market gives us the *gross basis*:

+Futures Price	+$129,372.53
−Cash Price	−$132,906.25
Gross Basis	= −$3,533.72

$$\text{Gross Basis} = \frac{-3,533.72}{31.25} = -113.08 \text{ ticks}$$

3. Please calculate how many March 1994 Treasury bond futures contracts you need to sell to hedge all price change in the following portfolio of Treasury bonds:

Bond	Coupon	Maturity	Price	Yield	Modified Duration	Face Value	Market Value
Treasury	6 1/4	15-Aug-2023	101 5/32	6.1638%	13.3184	$75,000,000	$77,051,800.27
Treasury	8 1/2	15-Feb-2020	125 21/32	6.4569%	11.7578	$55,000,000	$70,292,391.30
Treasury	12 1/2	15-Aug-2009	164 3/32	6.1050%	8.5638	$25,000,000	$41,813,179.35
Portfolio					11.6875	$155,000,000	$189,157,370.92
CTD	11 3/4	15-Nov-2009	156 19/32	6.1436%	8.8916		

To hedge all price change in the above portfolio, we need to offset the entire duration of the portfolio. We can calculate the number of futures contracts we need to sell by using the modified duration hedge ratio formula:

$$\#C = -\frac{PV_U}{PV_{CTD}} \times \frac{MD_U}{MD_{CTD}} \times \frac{CF}{FV_F} \times \frac{\Delta i_U}{\Delta i_{CTD}}$$

Plugging in the numbers to the above equation yields the number of contracts we have to sell. In this case the underlying position is the entire portfolio, and we can use the market value and modified duration of the portfolio in the above formula.

But first we have to calculate the dirty price of the CTD. We will use the HP12C:

		Value	*Key*	*Display*
1)	Clear financial registers and set accuracy to 4 digits		[f][REG] [f][4]	0.0000
2)	Enter the YTM	6.1436	[i]	6.1436
3)	Enter the coupon	11.75	[PMT]	11.7500
4)	Enter the settlement date	11.161993	[ENTER]	11.1620
5)	Enter the maturity date and calculate the bond's price	11.152009	[f][PRICE]	156.5931